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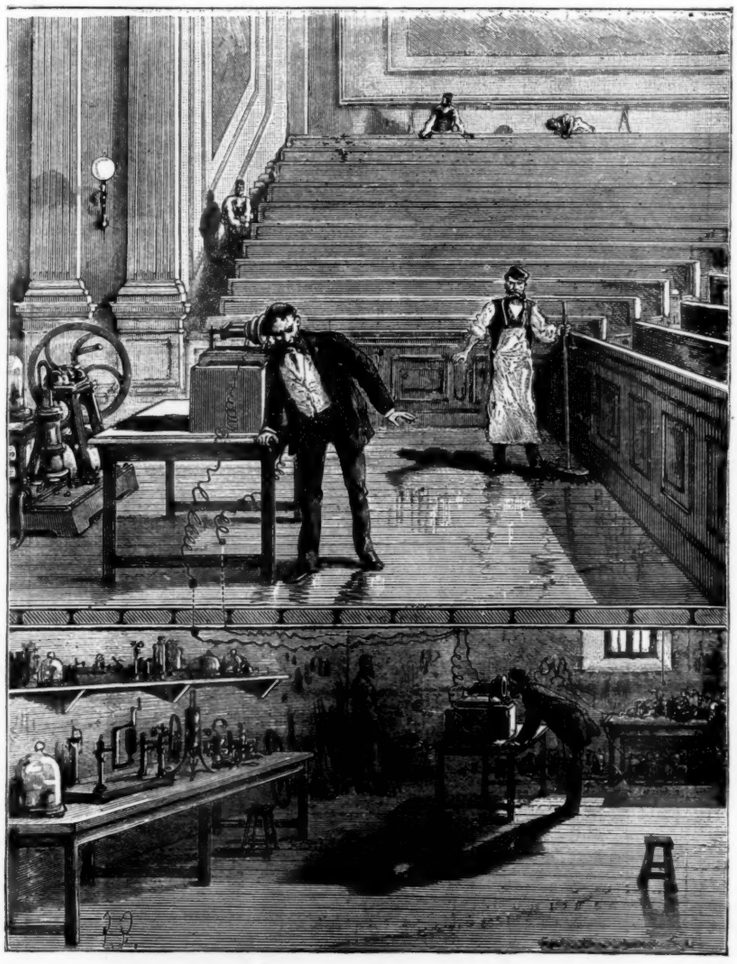
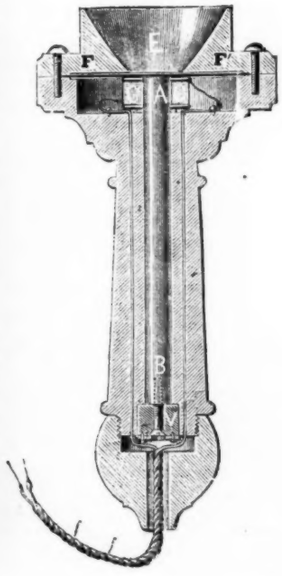
Present Progress and Future Prospects of the Telephone.

REIS'S INGENIOUS APPARATUS—IT CREATES LITTLE INTEREST IN EUROPE—A YANKEE INVENTOR WORKS AT IT—A PRACTICAL AND USEFUL APPARATUS RESULTS—ITS ADVANTAGES IMMEDIATELY SEEN ON THIS SIDE OF THE WATER.

The wonderful powers of the telephone, its surpassing usefulness in the affairs of life, and the extraordinary success which has attended the efforts of its projectors, serve to make every little detail concerning its inception and introduction of more than ordinary interest. Therefore it is that we herewith present to the readers of the New York ELECTRICAL REVIEW a group of pictures, made by M. Louis Figuier for the *Nouvelle Conquêtes de la Science.*





Scientific discoveries that may in any way become useful in the arts, in manufactures and business, are now regarded with universal attention, and, if they have real merits, find an immediate application upon a commercial scale, and almost invariably prove of profit both to the inventor and the public.

This tends greatly to the advantage of science, because the commercial value of any discovery gives a new impulse to research. The announcement of a new invention is followed by renewed research on a wider scale by many investigators. The telephone is an illustration of this, for it was not only at once adopted in business, but the labors of a large number of experimenters led to new discoveries and improvements.

One of the most interesting and remarkable things about the telephone is that though the crude theory upon which it is constructed was evolved by a German, Philip Reis, as long ago as 1860, it was left for Yankee ingenuity to make it a practical success. The inventors and mechanicians of Europe could see nothing of practical value in the germ which that grand investigator Reis had discovered. So it has been with many other devices which now are become almost indispensable to society. Whether it is that the activity, enterprise and daring, necessary to all great endeavors, are qualities more generally diffused under a republican form of government, we will not pretend to say; but it may be set down as a truth, so apparent as to require no confirmative evidence, which, however, may easily be had, that it would be next to impossible for a great discovery, or even, like the rough apparatus of Reis, a crude conception to lie dormant in America for want of those of sufficient intelligence to make known its advantages, or those of sufficient means to invest in it.

Up to a few months ago, the American Bell Telephone Company supplied the entire European market with telephone instruments and apparatus, and it is only now, six years after the telephone was shown to be a great commercial success, that European manufacturers have reached a position which enables them to make their own telephones. To-day, the great city of London, a city having four million inhabitants, is worse off, so far as telephone service is concerned, than innumerable small towns in the United States. Great strides are now making to perfect the London telephone systems, and no doubt in the near future, the American system will be introduced on a large scale, but invaluable time has been lost in getting the cumbrous machinery of the English mind to bear upon the subject.

Referring again to Reis' discoveries in the transmission of sound, it is remarkable that enterprising men did not appear nearer than the United States to carry them to a practical conclusion.

The transmitters which Reis devised embody—though their mechanical design is less perfect and their performance consequently less certain—all the essential principles of the telephonic transmitters in use to-day, such as Blake's, Berliner's and Crossley's. The receivers devised by Reis, more particularly the second form, anticipate every principle essential in the more modern and convenient receiver of Graham Bell, having an electro-magnet combined with an armature capable of inductive action—*i. e.*, made of

iron, elastically mounted and having an extended surface.

To Bell belongs the credit of having made the very great improvement of uniting these three qualities essential to the armature in use, by employing as armature a thin, flexible iron-plate; and it is but an act of simple justice to Bell to say that he has explicitly referred to Reis's prior work, even going to the extent of naming the pages of Kuhn's handbook, from which his references were taken.

The rate at which the telephone has grown in this country is remarkable. So popular has it become that a large number of enterprising and intelligent investigators and inventors have been attracted into the field of telephone improvement. The following table taken from one compiled by Mr. C. J. Kintner, chief examiner of the Patent Office, gives the whole number of telephone patents taken out:

Patents Granted Relating to Telephones.	Up to July, 1881.	July, 1881, to July, 1882.	July, 1882, to July, 1883.	Total.
Telephonic telegraph calls	61	33	13	107
" Details	7	5	3	15
" Electric	102	50	33	185
" Magnetic	66	26	16	108
" Mechanical	22	10	13	45
" Radiophones	6	.....	.....	6
" Reed	30	1	2	33
" Relays & Rep't'rs	4	7	1	12
" Systems	103	72	78	253
	401	204	159	764

As illustrating the avidity with which the business men of the New World seize upon whatever will facilitate commercial transactions or save time as compared to their brethren of the Old World, the following tables may not be found devoid of interest.

Here is a table representing the present status of the telephone in England and Scotland, the exchanges being operated by the National Telephone Company, No. 11 Queen Victoria Street, London:

STATEMENT OF SUBSCRIBERS.

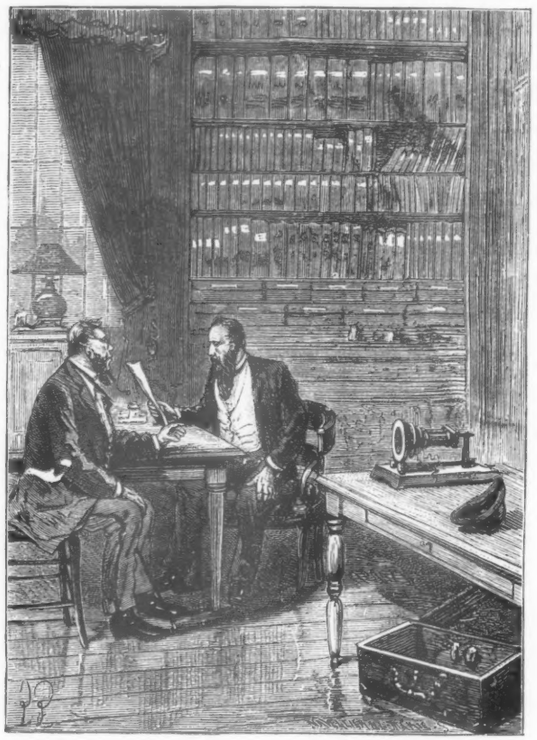
Stations.	Sub. up to July 31, 1881.	Sub. up to July 31, 1882.	Sub. up to Oct. 31, 1882.	Sub. up to May 31, 1883.
Glasgow	523	681	695	734
Greenock	33	63	65	74
Paisley	3	17	19	41
Edinburgh	171	216	224	258
Kirkaldy	*nil*	7	21	36
Aberdeen	"	18	26	44
Dundee, Forfar	15	27	78	91
Belfast, I.	133	207	231	245
Leeds	79	129	147	165
Bradford	67	178	201	225
Huddersfield	*nil*	40	46	59
Halifax	"	13	20	34
Dewsbury	"	26	45	57
Birmingham	71	138	145	163
Wolverhampton	19	31	37	51
Walsall	*nil*	9	26	37
Nottingham	"	88	105	143

Let us turn now to the annual report of the American Bell Telephone Company of February 28, 1883, which includes about the same period. The recent report, it should be said, shows a still greater increase:

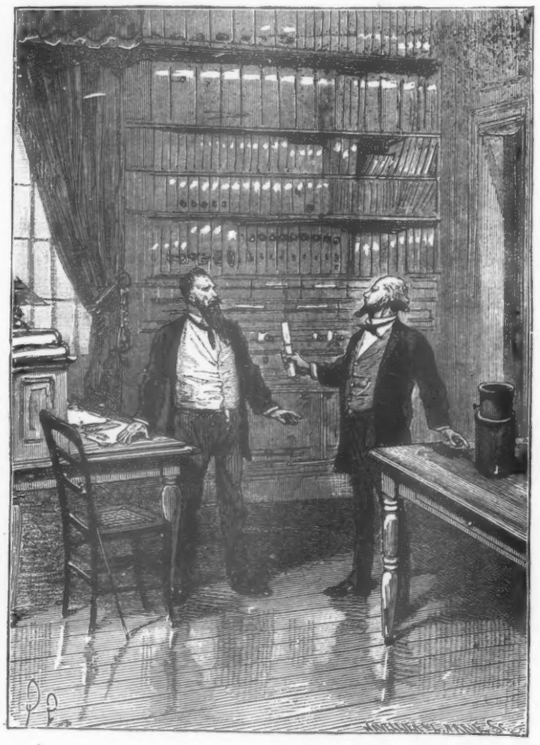
	Jan. 1, 1882.	Jan. 1, 1883.	Increase.
Exchanges in operation	486	735	249
Subscribers	70,525	97,735	27,210
Miles of wire	49,168	69,452	20,284
EXTRA TERRITORIAL LINES.			
Licenses issued	75	256	181
Miles of pole lines	2,007	6,154	4,147
Miles of wire	3,037	13,653	10,616

There were under rental February 20, 1882, 189,374 instruments, and February 20, 1883, 249,711—a gain of 60,337.

The illustrations which we give on this page of the REVIEW represent, so says the *Nouvelles Conquêtes de la Science*, the agents of two famous telephone inventors applying



THESE ILLUSTRATIONS REPRESENT THE EXAMINER'S ROOM IN PATENT OFFICE, AT WASHINGTON, D. C.



at the Patent Office in Washington, and Prof. Graham Bell in the act of experimenting with his second and most famous telephone, and lastly a correct representation of the Bell telephone both in perspective and cross-section.

To the general reader unfamiliar with the details of the telephone system now in operation, a few words concerning the American Bell Company, which is absolute master of the telephone field in this country, may not prove uninteresting.

Up to the present time the Bell Company has proved superior to every obstacle in its path, and if its claims are to be construed by every court as covering any and all methods of transmitting speech electrically, then telephone inventors must be content with the bare possibility of disposing of their inventions to the controlling power; but if, on the other hand, the Bell patents are found to cover only a specific method and apparatus for transmitting speech, then there is a field in which inventors may work with prospects of a reward. It has been held by some that the Bell patent covers only the method of and apparatus for transmitting speech electrically by means of undulatory currents of electricity. On the other hand, the company's experts and counsel hold that there can be no other method, while it is claimed by others that another method; and other apparatus may be employed to accomplish the same end. In all these phases of the telephone problem, says an authority, there arise questions for which there is now no answer. The most intricate points of law, he says, as well as the most subtle physical principles, are involved, and now the question is as to the advisability of pursuing telephone investigations for purely monetary considerations.

Says the same authority: "Let the legal aspect of the matter be as it may, it is positive that the accomplishment of certain improvements in the telephone would yield a far richer harvest than has been reaped by any inventor in this line. It should be no source of discouragement to the determined and intelligent inventor that hundreds and probably thousands have reached toward the prize with a grasp too short, for it is only a faithful index of the great value of the prize that so many have striven for it.

The results to be attained are continuity, uniformity and reliability of action, increased volume of sound, freedom from external disturbance, increased distance and better service for less money. How all this is to be accomplished, no one, there is reason to believe, is at the present moment able to say, but a few of the obvious things to be done are to reduce the delicacy of the apparatus, to increase the current used on the line wire, and to use a current of lower potential and to isolate the telephone wires from other line wires carrying heavy currents.

The fact that 764 patents had been granted for telephonic improvements, as is shown in the first of the tables given in this article, will naturally do much to discourage inventors. "Let the student of telephoning consider, however, that there is a great similarity between many of the telephone inventions," says an authority, "that the variations are mostly structural, and not in principle; that the majority of inventors are wedded to certain accepted theories; and finally, that most, if not all of them, are in the same groove, and that, to obtain new results there must be a radical departure from the reigning idea; then he will look for means and methods differing from those of his predecessors."

It is not unreasonable to believe that the telephone of the future will be a perfect instrument, that it will speak out in the ordinary conversational tone, and which may be spoken to in the same tone; and finally, that great as has already been its strides into popular favor, as one of the subjoined tables shows, the application of the telephone in the future to the affairs of life, shall make its progress of to-day appear insignificant.

The Java Earthquake and the Telephone.

Engineering (London) says that it has been before observed that earthquakes and volcanic eruptions have a disturbing effect on telegraph lines, setting up powerful earth currents in them, and rendering communication difficult. Recent advices from Mr. Weaver, the superintendent of the Oriental Telephone Company at Singapore, also announce the fact that during the recent earthquake at Java and eruptions of the volcano of Krakatoa, the telephone lines in Singapore were unworkable, owing to a deafening roar which drowned the voice. Only shouting could be heard on the lines, because of the noise, which resembled that of a distant waterfall. On one line, in which a small subaqueous cable about a mile in length, from Singapore to Ishore, formed part of the circuit, the roar was mingled with occasional reports like that of a pistol.

The volcano of Krakatoa is situated on the island of that name in the Straits of Sunda, between the southern end of Sumatra and the northern end of Java. It is about five hundred miles south of Singapore with a corner of Sumatra intervening. The noises in question were heard during the eruption on August 27th last, but can hardly be considered as due to acoustical effects, notwith-

standing the violence of the eruption. The cause is perhaps rather to be sought in the disturbance of the terrestrial magnetic field, or in the electric state of the atmosphere, by the terrific explosion.

The first signs of the eruption were noticed on August 25th, when shocks of earthquakes were felt as far as Batavia, and a fine ash began to fall, intermingled with red-hot stones. The waters of the Straits then began to boil, their temperature rising some 20 deg. C., and great blocks of lava fell on the neighboring coasts of Java and Sumatra. On the 26th the earthquakes became more pronounced, and at noon the Maka-Meru, the largest of the craters, began to break forth into flame. The Goumang-Gunter and the smaller craters then joined in, until forty-five neighboring craters were in action. Torrents of sulphurous mud and lava burst out, and at intervals tremendous explosions were heard, followed by showers of stone and ashes. The clouds were heavily charged with electricity, and lightnings played vividly. Next day the shocks and eruptions increased, and were accompanied by tidal waves. The Island of Krakatoa entirely disappeared, and the destruction was frightful, as the newspaper reports have already testified.

Rondeau.

IN THE TELEPHONE CLOSET.

Hello! hello! My darling Nell,
I know your touch upon the bell;
It thrilled, as often does my heart,
When you, your loving glances dart.
I can't hear, dearest. Louder! *Yell!*

Speak slower, loved one, you must spell,
For what you say, I cannot tell,
We are so *very* far apart—
Hello! hello!

I'm at the office, and must sell—
What do you say? To go to—well?
Good gracious! Tell me whom thou art?
"Shut up, young feller, and depart!
I want the druggist—calomel!"
Hello! hello!
H. L. SATTERLEE.

Chess by Telephone.

An exchange says, on Saturday last a game of chess was played between Wolverhampton and Birmingham, England, by means of the telephone. The Wolverhampton players were seated in the National Telephone Company's office, in that town, while the Birmingham players were at the Curzon Hall. The game was played with living pieces. The result of this game was a draw. It was intended to play games selected from the works of English and foreign players, during the past week, and to publish the results on a board in Curzon Hall, where a bazar is being held. The telephonic arrangements were carried out under the superintendence of Mr. R. Ryder (district secretary) of the National Telephone Company, at Birmingham. Games with living pieces have become somewhat common of late, but we believe that this is the first occasion upon which their movements have been directed by telephone.

The increase in the subscribers of the several telephone companies, under the Lowell management, since November 1, 1882, shows as follows:

Companies.	Connected Nov. 1, 1882.	Connected Oct. 1, 1883.	Increase.
National Bell, of Maine	3,600	4,017	417
Boston and Northern.	2,500	3,479	979
Suburban	610	1,578	968
Bay State	2,100	2,888	788
Manchester	410	403	Dec. 7.
Union	240	465	225

Telephone conversation has been successfully held between Albany and Rutland—120 miles. Troy will be placed in connection this week.

The Pennsylvania Telephone Company has nearly 500 subscribers in the city of Reading and vicinity. The company has just opened communication with Lancaster, York, Norristown and intermediate stations, and the construction of new lines is being pushed forward as rapidly as possible.

The Tropical Telephone Company, of Boston, has shipped $25,000 worth of instruments to Rio de Janeiro, the money for which is deposited to its credit in New York.

Hollow Magnets.

While Preece has found that there is no difference in the conducting power of lightning rods of various forms, Holtz has concluded that solid steel bars do not form so good permanent magnets as tubes, because the core acts as an armature joining the two poles. In experimenting to test his hypothesis, he magnetized rods and tubes to saturation, and found that the magnetism of the tube showed an excess of more than 50 per cent. After waiting six months, he subjected the same magnets to new tests, in order to find which retained the magnetism best. He found that the magnetism of the solid was to that of the hollow magnets, in one case as 1 : 2.5, in another as 1 : 2.9 — *Weid. Annalen.*

The Thompson-Houston Electric Light Company, of Lynn, Mass., have paid a dividend of $7 per share. This company has been very successful since its reorganization and removal from New Britain, Conn., only a short time ago. Within the past year its advancement has been great, as the dividend shows.

Electric Lights in Maine.

PORTLAND.—The Consolidated Electric Light Company of Maine have placed five electric lights in City Hall, and they were tried on October 18 for the first time. During the lecture the hall was of course darkened, the electric lights being switched off. At the close of the lecture the current was put on and the pure white light of the American system flooded the hall with brilliancy. The audience present viewed the light as they passed through and out of the hall to observe its appearance and effect on the colors and to compare its brilliancy with other illuminators. Judging from casual remarks on all sides, the opinion was pretty general that the light was even more brilliant than before, while its effect upon the tints of the walls and ceiling was to bring out the colors with greater distinctness. Another point in favor of the electric light in City Hall or in any public hall is its freedom from heat and its equal freedom from any vitiating effects upon the atmosphere. A committee from the Maine Charitable Mechanics' Association was present at the close of the lecture to observe the points, advantageous or otherwise, about the new light. They were so well pleased with its appearance and effect that they ordered Supt. Sawyer to place the Consolidated Company's light in their hall, and it will be used there for the first time in a few days. There are also in the city building three other lights of this company, one at the head of the main stairway, one in the Aldermen's room, and one in the room of the Common Council.

An Insulite Battery.

The British Insulite Company, Limited, have introduced a useful form of battery. The cell is sealed, and can give off no fumes in a house where it may be employed. The outer vessel, which is rectangular, is made of insulite, a material impervious to liquid and self-cementing. A partition of porous clay is cemented diagonally across the cell from corner to corner. In one corner is a zinc rod, and in the other is a carbon rod surrounded by pieces of carbon. A special solution is employed to excite the battery. The connections are made by binding screws on the lid, in which there is also a release valve to provide for expansion of the air within. The cell, when sealed, can be inverted or put in any position without damage, and lasts two years without renewal of zinc.

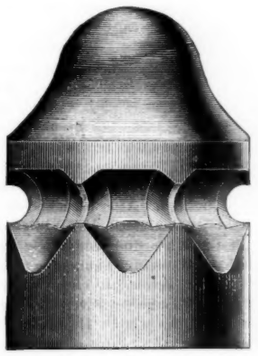
The Fiske-Mott High-Resistance Insulator.

The principle of this insulator will become apparent to any electrician at a glance, and his first feeling will probably be one of surprise that he had not thought of it himself. Like most inventions that find their way instantly into use, it is extremely simple, and fulfils exactly the purpose for which it is intended.

In order to see clearly the reasons for the efficiency of this device, let us first review the conditions to be satisfied in an efficient insulator, and also the causes that operate to promote leakage.

In the first place, an insulator must be of very poor conducting material. The Chicago Insulator Company meet this requirement by making their articles of glass, or of a special patented composition of their own, possessing high insulating properties.

Secondly — An insulator should offer as little surface as possible to the wire, for the reason that the amount of conductivity of a body varies as to section, and the leakage of any line varies as the length of wire exposed to leakage. The insulation resistance of a line one mile long is twice as great as that of a line two miles long, simply because it exposes only half as much surface for leakage. Now, it is evident that the leakage upon any line is due almost wholly to leakage *at the insulators;* so that, if we can reduce the leakage at those points, we shall attack the evil at its root. Bearing in mind the fact that the amount of leakage varies as the surface exposed to leakage, we see at once a way



to do this, *i. e.*, decrease the amount of contact between the wire and each insulator. This is what is done in the device under consideration. The groove within which the binding and line wires are secured is simply corrugated or grooved, so that the wires lie upon a series of edges. The amount of surface of the wire exposed to leakage is, therefore, the sum of the surfaces of contact on the ribs.

With the company's pattern, this sum is about one-tenth of that in an ordinary insulator. The insulation, therefore, is, roughly, ten times as great.

In the third place, an insulator should be so formed that water and dirt cannot lodge around the wire, because there would soon form a conducting layer over the surface. In this insulator there is no place for any such lodgment whatever, as the wire stands out clear from the surface.

In the fourth place, the device should be so formed, if possible, that the natural phenomena of wind and rain shall of themselves keep it clean; otherwise much labor will be entailed.

A glance will show how admirably this is here effected, for the wind and rain will evidently blow out and wash out any deposit that might otherwise accumulate about the wire.

For the rest, an insulator should be strong—not liable to break or crack in use or in transportation. As the ribs upon which the wire rests lie wholly within the groove, they are clearly protected from any accident, and the body of the insulator is made in the most approved and solid fashion.

It is believed that an impartial consideration of the practical requirements of an efficient insulator will lead to an emphatic indorsement of this one by all telegraph engineers.

The Chicago Insulating Company are evidently possessed of both judgment and enterprise, and we cordially wish them the success they deserve.

At the meeting of the New York Electrical Society, Friday, Nov. 2d, the following resolutions on the death of Prof. C. F. Varley, were unanimously adopted as the sense of the Society:

Whereas, By the death of Prof. C. F. Varley, the Science of Electricity has lost one of its most devoted disciples; and

Whereas, By reason of his professional connection with the laying of the first Atlantic cables, as well as by his numerous electrical writings and inventions, his name will always be associated with the history of the development of the science of electricity in the nineteenth century; and

Whereas, In view of the foregoing, it is but proper, that we, as a Society, organized for the study of the science of which the late Prof. C. F. Varley was so industrious a student and so successful an exponent, should make suitable expression of the sorrow with which the announcement of his death was received by us: therefore, it is

Resolved, That this Society does hereby express its sincere regret at the loss by death of the late Prof. C. F. Varley; and further

Resolved, That a copy of these resolutions be spread on the minutes of this Society; and also

Resolved, That the electrical papers of New York City be requested to publish these resolutions.

The lecture on "Measurement of Velocities by Electricity," which was to have been delivered by Mr. F. W. Cushing, Electrician for the Postal Telegraph Company, was indefinitely postponed on account of the unexpected absence from the city of that gentleman. In lieu thereof, Mr. James Hamblet, of the Time Service, made some interesting remarks on the subject of Synchronizing Clocks by Electricity.

The membership of the Society was augmented to the extent of about a dozen names.

Mr. J. H. Emerick, Superintendent of the Postal Telegraph Company, was elected a member of the Executive Committee, vice Mr. E. C. Cockey, resigned.

The experiment of lighting the Hartford (Conn.) Opera House with electricity works well, and the manager says it is the first theater in the country to adopt the arc light.

Speaking of the electric light in New Bedford, the *Standard* says: The building on the north side of School street, just west of Front, to contain the engines of the New Bedford Electric Lighting Company and other necessary apparatus, is substantially completed. One engine of 50-horse power built by Armington & Sims, of Providence, is already put in, and a foundation is laid for another of equal power when it shall be found necessary. The engine now in position will furnish power sufficient to generate electricity for fifty lights. In the rear of the main building a boiler house will be erected, and a boiler of 100-horse power, built by Thomas Cunningham, of the Charlestown district, Boston, has been put in position. This will be set with the Jarvis Patent Furnace. The work of erecting poles and stretching the wire will begin in a few days.

There is being constructed at Glasgow a large electric launch, in which it is intended to make a trip from the North to the Black Sea, through the rivers Rhine and Danube and their artificial junction. A trial trip was recently made on the Clyde in a smaller launch, built in Waukegan, Ill., and was quite successful. The launch will be driven by Clark's patent battery and motor. It is anticipated that a speed of ten knots an hour will be attained.

Experiments in Bolometry.*

By Prof. Sylvanus P. Thompson.

Hitherto the bolometers devised by Langly and others have been constructed of thin films blackened with lamp black or platinum black. Abstract considerations show, however, that to have maximum degree of sensitiveness the conductor employed should be one in which the change of electric resistance per degree of temperature is the greatest; it should also have as small a thermal capacity as possible, and its exposed surface should be its only conducting part. Theoretically, therefore, a carbon film in some high-conducting form should be the best. Pending the preparation of special carbon films, the author had made some experiments on the strips and filaments of carbon which are to be found in incandescent lamps. The resistance of these, when carefully measured on a Kirchhoff bridge, was found to be considerably less when exposed to radiation than when kept in the dark, the change of resistance in some cases amounting to one per cent. of the total resistance. The cylindrical filament and rectangular strips used in most lamps are not, however, well adapted to show the bolometric effect, as their exposed surface is small as compared with the area of the cross-section of the conductor. These observations suggest the following points: (1), that measurements made for specifying the resistances of such lamps should be conducted in the dark; (2), that a carbon film, or even a carbon lamp, may serve as the receiving part of a photophone; (3), that probably the effects obtained by Dr. Börnstein with metals might be re-observed if the metal films were very thin; (4), that special films of good conducting carbon should be applied in standard bolometers; (5), that a time standard photometer might be constructed on the bolometric principle, having the sensitive conducting film covered with *pigmentum nigrum* from the human eye. Such an instrument ought to be sensitive to precisely the same rays as the eye itself, and in identically relative proportions for different rays.

Faure's Electric Accumulator.

The extensive litigation which has progressed for nearly a year in the several courts of this city, wherein the Electrical Power Storage Company of London, have brought suits for the recovery and possession of interests in the Faure patent for secondary batteries claimed to be due them as assigns of the Belgian Company, styled the Société Anonyme La Force et la Lumière. The same subsequently brought a suit in the name of the Light and Force Company against several licenses and subsidiary companies, which action is now pending in the Superior Court of this city. The news just received from Europe of suits lately decided in Belgium concerning the Société Anonyme la Force et la Lumière, seems to affect alleged transfers of interests, &c., made during the summer and fall of the year 1882, and upon which are based the various actions which we first alluded to. As it appears, the Court of Appeals of Belgium decides that proceedings of the years 1882 and 1883 are illegal and void, and we learn that the preferred shareholders of the Belgian Company claim that the alleged transfers to the English company were unauthorized and are of no value, and that they are taking energetic steps to enforce the rights and interests of their corporation. This is confirmed by the news which reaches us from Paris that Mr. Philippart, who was formerly the representative of the interests of this company, has received a severe check in an attempt to float two local companies in Paris, notwithstanding the success that has been reported to have resulted from the application of Faure accumulators to tramcar and omnibus traffic. The Belgian Company have made a call for a meeting of the stockholders for action under the decisions of the court.

* Paper read before the British Association, Southport meeting, September, 1883.

The Thompson-Houston Electric Company are to equip an electric lighting station in Syracuse, N. Y., of 100 lamps. They will set one 100-horse power tubular boiler, with the Jarvis Patent Furnace to burn screenings and slack coal, two 9½x12 inch Armington & Sims engines to run dynamo-electric machines direct, without shafting, steam pumps, etc., making a complete station. The plant will be laid out so to allow its being increased to 400 lights run by eight separate engines.

The New Buffalo Electrical Society.

The third semi-monthly meeting of the Buffalo Electrical Society was held at Temperance Hall, Friday evening, October 19. This society, says the *Express*, was formed for the purpose of promoting the advancement of electrical knowledge among its members. There are, it is stated, a large number of expert operators in the service who have no knowledge of the scientific principles of electricity, and hence are hardly eligible to take charge of departments. Such persons in particular these meetings are designed to benefit. There are those who have made the science a study, but through long absence from books have let their minds become rusty on the subject, and to these the society will be profitable. It is expected that those who have never studied will use text books, and at each session a paper will be read which will bear on that branch of the subject which the students have in hand, after which discussions will be held and questions answered. In addition to this the society will establish a laboratory, library, and reading room. The meetings are not confined alone to telegraph men, but are open to any one who takes an interest in the subject of electricity. Among the thirty-six members already elected, who are not in the employ of the telegraph companies, are Prof. Poole and Dr. Bonner. Other local scientists are expected to join. At the meeting last evening the executive committee reported that the lease of Temperance Hall had been secured to the 1st of May, with permission to relet if desired. After other society business had been transacted, Mr. William Finn, chief of the Wheatstone Automatic Department of the Western Union, gave a lecture on "Electric Terms," a clear knowledge of which, he thought, was very necessary at the outset of the work. He made strange words plain by a liberal use of chalk on the blackboard. The next meeting will be held on the first Friday in November, at which time it is expected to have a wire run from the Western Union office to a battery in the hall, to enable illustrations to be shown. The subject for the coming lecture has not yet been announced.

Sabin's Electric Engine.

"A little two-horse power electric engine was revolving rapidly at Freeman & Daly's electrical supply office, in William Street yesterday, says the New York *Times* of Oct 21st. Its peculiarity was that it was a piston movement engine, and it was exhibited by L. M. Sabin, formerly of St. Louis, who claims that it is the first of that movement which has been manufactured in this country. The engine is supplied from a battery, and consists of four electro-magnets, two on each side, with armatures of permanent magnets. While one attracts, another repels, giving the piston movement of the common steam locomotive, and the little engine is similar to this in the remainder of its mechanism. This engine of two-horse power, Mr. Sabin says, will revolve from 600 to 1,000 times a minute. It cost $150, and the electricity of a storage battery to run it a day of twelve hours will cost, he estimates, 50 cents. It takes up little space, and can easily be placed under a car. The engine is to be tested at once on church organs, propeller or steam yachts, and printing presses. Its inventor also hopes to adapt it to road carriages, and believes that cabs can be run by it for 50 cents a day." To those interested in the progress of electrical science this machine is important, and if its successful and economical operation is confirmed, as there now seems every reason to believe it will be, some of the problems of electric motors will be solved. In an early edition of the Electrical Review we will give illustrations and a description of this ingenious machine.

A New Selenium Cell.

Engineering says, at the recent meeting of the American Association for the Advancement of Science, Professor Mendenhall announced the formation of selenium cells of very low resistance by Mr. C. E. Fritts, of New York. Low resistance selenium cells are a desideratum, and Mr. Fritts' cells, the full construction of which was not explained by Professor Mendenhall, attain their end by means of large surfaces of selenium, instead of narrow surfaces as in the older cells. Another peculiarity, which involves a new observation, is that the light in the Fritts cell is allowed to fall on the selenium in the same direction as the electric current passes, and not at right angles to the direction of the current. This is a very important point demanding further investigation, and now that selenium can be manufactured more cheaply it will probably be largely experimented with. The cells of Mr. Fritts can be made of nine to ten ohms resistance. They can, moreover, be easily repaired on breaking down.

It is said that the Swan United Electric Light Company of London have received the order to fit up the White Star line steamship *Adriatic* with Swan lamps. Siemens's alternate current dynamos will be used, and they will be duplicated to provide for contingencies. The dynamos will be driven by two pairs of powerful-coupled engines, by means of rope belting. The total number of lamps employed will be 132, of 20 candle-power, and 150 of 12 candle-power. Should this installation prove satisfactory to the owners of the vessel, it is their intention to introduce incandescent lighting into others of their large fleet of steamers.

A New Interrupter.

Our very highly esteemed contemporary, the *Electrician*, of London, says: Herr E. Budde some time since devised a new form of mercury interrupter. It is known that when an ordinary mercury interrupter works in air the surface of the mercury becomes oxidized, owing to the sparking which takes place. To avoid this, Herr Budde surrounded the mercury with an atmosphere of hydrogen. He used an interrupter like that of Foucault, and covered it with a glass case. Into this case he directed a current of pure and dry hydrogen. The gas was caused to pass first over concentrated sulphuric acid and then over lime. When the atmosphere in the case had been replaced by hydrogen, the interrupter was set in motion, and the stream of hydrogen was almost entirely stopped. Under these conditions Herr Budde stated that mercury would remain bright after four hours' work.

The Tucson Electric Light Company, of Tucson, Arizona, has recently started its new lighting station. The plant consists of a 40 and 16-light Brush machine, driven by a 60 horse-power Westinghouse automatic engine.

Julius Elster and Hans Geitel show that Zamboni's dry piles can be used as accumulators. The copper pole of the pile is connected with the positive, and the tin pole with the negative poles of a Holtz machine. After the latter has been worked for a few minutes the dry pile is found to be charged. After repeated discharges the pile is found to contain a charge of considerable intensity. The authors recommend the following form of pile: The plates of the pile are strung by means of a needle upon a silk thread, and then stretched between the poles of a Holtz machine. A pile of 11,000 pairs of plates of one square centimeter surface, after ten minutes' charging, gave shocks one millimeter long and made a Geissler tube luminous. The light of the tube was continuous at first, but afterward became intermittent. Dry piles were also made of one metal. Plates of lead foil were coated on both sides with tissue paper by means of potash water-glass, to which a little oxide of lead was added. A pile of 7,000 of the lead plates one square centimeter in section could be charged so as to exhibit strong polarization. A certain amount of moisture must be communicated to the piles. The superoxide of lead deposited electrolytically acts more powerfully than when deposited in any other way. A pile of 1,000 plates, coated on one side with chemicately produced superoxide and on the other with protoxide of lead, gave proportionally much less tension. These piles are well suited to exhibit to a large audience the principle of Plante's or Faure's accumulator. — *Wiedemann's Annalen.*

The production of light from electricity is so well known that it may have seemed singular that light would not generate electricity. The latter has actually been accomplished by Sauer, who has constructed a battery that acts only in sunlight. In this case it is the chemical constituent of the light that furnishes the power. Heat rays acting upon a thermo pile also produce a current. Sauer's battery consists of a glass vessel containing a solution of fifteen parts of table salt and seven parts of sulphate of copper in 106 parts of water. Within is a porous cell containing mercury; the other is of sulphide of silver, and is placed in the salt solution. Both are connected with a galvanometer, and the whole is inclosed in a box when not in use. When the battery is placed in the sunlight, the galvanometer needle is deflected to a certain point, and the sulphide of silver is found to be the negative pole. Any change in the intensity of the light, such as a cloud over the sun, is indicated by the needle. The action of the battery depends on the effect of the chloride of copper upon the mercury. Subchloride is formed and reduces the sulphide of silver, but this can only take place with the aid of sunlight. Hitherto the only manner in which light seemed to affect electrical action was by increasing the resistance of a selenium cell, and all photo-electrical experiments were based on this phenomenon. Sauer's battery will be found described in the *Electrotechnische Zeitchrift.*

Professor Tice, an authority on electricity, which he claims to be the motive power of the universe, says: "Everything is moving; nothing stands still, nothing is stationary, the moving impulse being electricity. It moves your hand, it moves all the planets, in their orbits. According to some, the Creator hurled those vast orbs into space and they were set moving, but the primitive impulse was electricity, the prime cause of all motion. It is unquestionably the motive power. We have the earth moving eighteen miles and sixteenths in a second around its orbit; electricity is the cause. Electricity is convertible into light and heat, and the time will come when electricity will be our fuel. But there is no way of storing it up for use. It has been given out in the public press that some one is storing it. That is an impossibility. If he has done anything, he has some chemical element that will not act on something else. Electricity will have to be evolved by either decomposition or recomposition, which must be done before electricity is evolved. Water will become the source of fuel; the lakes and rivers will be reservoirs of fuel wherever you have a cheap method of producing electricity. Electricity is the soul of the universe. You can't tell what it is any more than you can the soul of man. Your professors know nothing about it, except what they get from books. The so-called scientific men retard instead of advance truth. The whole theory of the old lightning rod is wrong. They try to accomplish an impossibility."

The Phœnix Electrical Company of Canada (Craig system) announces that it has contracted to furnish to the city of Pueblo, Mexico, a plant for lighting that city, consisting of four dynamos producing forty lights each, and a sixteen-light dynamo, with 175 street lamps of 2,000 candle-power each, 100,000 carbons, 120,000 feet of cable, and all the usual adjuncts.

Telegraphic.

Underground Telegraph Wires.

The General Committee on Underground Communication, whose object is to find a system by which the telegraph and other electric wires can be placed underground, has been at work all summer. It has been examining devices, looking up the question of franchise and law points, and also how the business organization can be effected. The problem has been most complex and difficult, but the Special Committee on Devices, to whom this branch of the subject was referred, believes that it has found a system, or rather parts of several systems, that may be combined so as to give a satisfactory solution of the problem. Over five hundred devices, from nearly every civilized country, have been examined by the committee. Nearly every day has brought forth some devices or inventions. As soon as this committee reports, which will occur before long, the Committees on Law and Franchises and Business Organization will make ready their reports. The committee is made up of prominent officers in nearly every telegraph and telephone company in the city. The Western Union was formerly represented by Vice-President Bates and others, but on Dr. Green's departure for Europe they withdrew from the committee.

DAILY TELEGRAMS.—In 1870 the number of telegrams sent and received per day in London alone was 400, or thereabouts; now it is nearer 6,000.

Telegraphing Chinese.

Owing to the peculiarity of the Chinese characters, each of which represents a word, not a letter, as in our western tongues, the Danish Telegraph Company (the Great Northern) working the new Chinese lines have adopted the following device. There are from five to six thousand characters or words in ordinary Chinese language, and the company have provided a wooden block or type for each of these. On one end of this block the character is cut or stamped out, and on the other end is a number representing the character. The clerk receives a message in numbers and takes the block of each number transmitted and stamps with the opposite end the proper Chinese character on the message form. Thus a Chinese message sent in figures is translated into Chinese characters again and forwarded to its destination. The sending clerk, of course, requires to know the numerical equivalent of the characters or have them found for him.

A new police telegraph, with ten miles of wire, has been introduced in New Haven. Ten alarm stations will be located at once.

To Protect Telegraph Cables.

PARIS, Oct. 29.—The International Conference for the Protection of Submarine Cables unanimously signed the draft of a convention for the protection of telegraph cables. M. Cochery, the French Minister of Posts and Telegraphs, expressed the hope that the convention would be sanctioned by treaties within three months. The question of the protection of the cables in time of war was reserved for diplomatic discussion.

The convention will apply outside of territorial waters to all submarine cables legally laid which touch the land in the territories of the contracting parties. The latter bind themselves, when authorizing the landing of cables, to impose conditions for their protection. Laying or repairing ships must observe the rules to avoid fouling. The tribunals competent to deal with infractions of the convention will be those of the country to which the ship in fault belongs. Ratifications will be exchanged at Paris within a year. Other States may join the convention on making application.

Statistics of Telegraphic Lines in Europe.

The international office of the European telegraphs has just published statistics of the number of telegraphic lines in each State, as follows:

Germany	10,508	lines
France	5,885	"
Great Britain	5,600	"
Russia	2,731	"
Austria	2,600	"
Italy	2,470	"
Switzerland	1,139	"
Hungary	1,069	"
Belgium	827	"
Sweden	788	"
Holland	418	"
Spain	389	"
Denmark	387	"
Norway	250	"
Roumania	206	"
Portugal	202	"
Greece	100	"
Bosnia	69	"
Luxembourg	64	"
Serbia	60	"
Bulgaria	37	"

The length of the telegraphic wires is established as follows:

Germany	260,680	kilometres
Russia	223,538	"
France	211,607	"
Great Britain	197,715	"
Austria	92,527	"
Italy	98,150	"
Hungary	54,852	"
Spain	40,742	"
Sweden	29,879	"
Belgium	27,922	"
Switzerland	16,155	"
Norway	15,601	"
Holland	14,153	"
Portugal	10,964	"
Roumania	8,662	"
Denmark	8,460	"
Greece	4,614	"
Bulgaria	3,400	"
Bosnia	3,180	"
Serbia	3,134	"
Luxembourg	556	"

The length of the underground wires reaches:

Germany	37.604	kilometers.
Great Britain	17.700	"
France	11.656	"
Holland	561	"
Austria	571	"
Switzerland	327	"
Russia	250	"
Belgium	232	"
Denmark	70	"
Roumania	43	"

Number of inhabitants for each telegraphic station:

Germany	4.388	inhabitants
Sweden	5.794	"
France	6.342	"
Great Britain	6.394	"
Norway	7.511	"
Austria	8.504	"
Italy	10.850	"
Russia	27.091	"
Spain	43.358	"

The Swedish and Danish Governments have decided to lay down a new submarine cable between the two countries. The cable, which will consist of four wires, will be laid from Heisingborg to Elsinore, via the island of Hveen.

Ten Corporations for Supplying Light and Heat Created.

HARRISBURGH, Pa.—The following charters were granted recently at the Executive Department:

Union Light and Heat Company of Westmoreland county, with office at Pittsburgh; capital stock $1,000,000. The directors are as follows: Millon Weston, Chicago; A. Blakely, Pittsburgh; J. L. Crawford, A. M. Sloam, and J. M. Wallace, of Greensburg.

O'Hara Light and Heat Company of Pittsburgh, capital $5,000.

Derry Light and Heat Company, of Westmoreland county, capital $5,000.

South Light and Heat Company, of Pittsburgh, capital $5,000.

Harman Light and Heat Company, of Pittsburgh, capital $5,000.

Pennsylvania Light and Heat Company, of Pittsburgh, capital $5,000.

Loyalhanna Light and Heat Company, of Westmoreland county, capital $5,000.

North Light and Heat Company, of Pittsburgh, capital $5,000.

Bell Township Light and Heat Company, of Westmoreland county, capital $5,000.

Plum Light and Heat Company, of Alleghany county, capital $5,000.

List of Officers and Directors of the Western Union Telegraph Company, Elected at the Last Annual Meeting.

Norvin Green, President.

Thos. T. Eckert, Vice-President and General Manager.

Augustus Schell, Harrison Durkee, John Van Horne, } Vice-Presidents.

D. H. Bates, Acting Vice-President and Assistant General Manager.

J. B. Van Every, Acting Vice-President and Auditor.

A. R. Brewer, Secretary.

R. H. Rochester, Treasurer.

Clarence Cary, Attorney.

BOARD OF DIRECTORS.

Norvin Green,	R. Lenox Kennedy,
Thos. T. Eckert,	Hugh J. Jewett,
John T. Terry,	J. Pierpont Morgan,
John Van Horne,	Frederick L. Ames,
Augustus Schell,	John Hay,
Harrison Durkee,	William D. Bishop,
Jay Gould,	C. P. Huntington,
Russell Sage,	George B. Roberts,
Alonzo B. Cornell,	Frank Work,
Sidney Dillon,	Samuel Sloan,
Cyrus W. Field,	Erastus Winans,
George J. Gould,	John J. Aster,
Jno. Pender, M. P.,	Chauncey M. Depew,
Henry Weaver,	James W. Clendenin,
Percy R. Pyne,	Christ. C. Baldwin.

EXECUTIVE COMMITTEE.

Norvin Green,	Jay Gould,
Thos. T. Eckert,	Russell Sage,
John T. Terry,	Alonzo B. Cornell,
John Van Horne,	Sidney Dillon,
Augustus Schell,	Cyrus W. Field,
Harrison Durkee,	George J. Gould.

EASTERN DIVISION GEN'L SUPERINTENDENT.

Charles A. Tinker.....New York.

EASTERN DIVISION DIST. SUPERINTENDENTS.

1 W. C. Humstone, New York.
2 R. S. Clinch, St. John, N. B.
3, 4 Thomas Roche, Boston, Mass.
5 S. B. Gifford, Syracuse, N. Y.
6 J. E. Zeublin, Philadelphia, Pa.
7 W. J. Holmes, New York.
8 Charles O. Rowe, Titusville, Pa.

CENTRAL DIVISION GEN'L SUPERINTENDENT.

R. C. Clowry.....Chicago, Ill.

CENTRAL DIVISION DIST. SUPERINTENDENTS.

1 F. H. Tubbs, Chicago, Ill.
2 L. C. Baker, St. Louis, Mo.
3 J. J. Dickey, Omaha, Neb.
4 Frank Jaynes, San Francisco.
5 E. P. Wright, Cleveland, O.
6 John F. Wallick, Indianapolis, Ind.
7 I. N. Miller, Cincinnati, O.
8 I. McMichael, Minneapolis, Minn.

SOUTHERN DIVISION GEN. SUPERINTENDENT.

G. W. Trabue.....Nashville, Tenn.

SOUTHERN DIVISION DIST. SUPERINTENDENTS.

1 J. B. Tree, Richmond, Va.
2 James Compton, Nashville, Tenn.
3 J. A. Brenner, Augusta, Ga.
4 C. G. Meriwether, Mobile, Ala.

James Merrihew, Assistant General Superintendent, New York.

William Holmes, Superintendent of Tariff and Check Bureau, New York.

D. Doren, General Superintendent of Construction, New York.

SUPPLY DEPARTMENT.

William Hunter, Superintendent and General Purchasing Agent, New York.

E. C. Cockey, Storekeeper, New York.

Jas. S. Dickinson, Storekeeper, Chicago.

The comparatively small city (about 100,000 inhabitants) of Chemnitz, in the mountains of Bavaria, sends to the United States nearly $10,000,000 worth of manufactures, mostly of cotton. Among the items in 1882 were $4,250,000 of cotton hosiery and $1,278,000 of cotton gloves. Here is something for the people of the country where the cotton grows to think about. What other people send their raw material three or four thousand miles away to be manufactured, and then returned to them, paying not only transportation charges both ways, but import duties besides? The thing is next to incredible.

The prosperous condition of the cotton industry in this country is shown by the statistics of exports. In 1825 there were no exports of cotton goods; in 1835 the value was $2,858,681; in 1845 it was $4,327,928; 1855, $5,857,181; 1865, $2,273,509; 1875, $3,071,882; 1882, $13,225,000; and for the first eight months of the present year, $8,414,433. Of this industry the *Economist* says: "Americans have driven the English not only from the American markets, but largely from the European markets, and even in the English markets we have commenced a not unsuccessful competition. We do not hope nor do we expect to at once step to the front in Eastern markets, under present conditions, but with time, study and patience our excellent manufactures will gain an unshaken foothold and compete on anything like even terms with those of other countries.

Lighting by the Sawyer-Man System.

The contract for lighting the new building of the Mutual Life Insurance Company on Nassau Street has been awarded to the Sawyer-Man Illuminating Company, which is the licensee in this city of the Consolidated Electric Light Company. The "plant" for supplying the light will consist of 1,500 standard 16-candle lamps and 10 Sawyer lamps of 125-candle power each, the latter to be used for lighting large in-door spaces. This apparatus will be the largest "isolated lighting plant" in the city. The steam power for operating it will be obtained from the pipes of the New York Steam Company.

The total value of importation of silk goods at New York during July, as reported by the Silk Culture Association of America, was $4,112,209, against $2,281,498 in July, 1882, $2,691,088 in July, 1881, and $3,181,358 and $2,232,824 respectively in July, 1880 and 1879. This shows a gain of $830,711 in the value of imports in July last, as against those of July, 1883.

Four Providence concerns sent cotton factory goods of the value of $100,000 to Shanghai, China, during September. These include 20,000 spindles, 10,000 American and 10,000 English, and the two kinds are to be run against each other to test the comparative values.

Fresno County, Cal., is making a canal 100 feet wide from King's River to irrigate 30,000,000 acres of dry and worthless desert.

At Reddich, Germany, 14,000 persons are engaged in making needles. The total production of needles in the world is 200,000,000 per week, or 10,000,000,000 per year.

It is expected that the Washington monument will reach a height of 410 feet before cold weather stops the work, and that it will be completed in the Spring of 1884. When the 500 vertical feet of masonry, surmounted by a pyramidal cap of fifty feet high, have been actually finished an imposing ceremonial will, of course, be necessary to crown the work, and Washington people are already looking to forward that event.

Mr. Scott Snell has made experiments on the use of asbestos paint for coating Jablochkoff candles. He finds that with pure asbestos paint the arc is much steadier and the carbons last much longer.

Telephonic.

The Pennsylvania Telephone Company.

While reports of the progress made and successes achieved by the various telephone companies throughout the land are constantly coming in, a few statements in reference to the telephone business in central Pennsylvania will be of great interest to our readers.

As in most parts of the country, so in Pennsylvania, prominent officials of the Western Union Telegraph Company were the first to take hold of the telephone business. Mr. Horace A. Clute, for many years an efficient manager of the Western Union Telegraph Company, was the pioneer in this respect in central Pennsylvania. Harrisburg was his headquarters, and from that point he operated with much success, introducing the telephone in the various surrounding business communities. During the summer of 1882, Hon. Gardener G. Hubbard, who has been prominently connected with the telephone from its beginning, purchased Mr. Clute's interests, together with those of a number of other individuals, as well as of several small companies, with a view of consolidating them all under one general management. A contract was then made with the American Bell Telephone Company, by which various temporary leases—over twenty in all—were surrendered, and a permanent lease obtained from that company for all its telephone rights and interests in the counties of Adams, Cumberland, Dauphin, Franklin, Fulton, Lancaster, Perry, York, Lebanon, Berks, Schuylkill, Monroe, Carbon, Lehigh, and Northampton.

A corporation was formed under the title of the Pennsylvania Telephone Company; the capital was fixed at $500,000, in ten thousand shares of a par value of $50. Hon. Francis Jordan, ex-Secretary of State, was chosen president, and Mr. Wm. Ker was selected general manager, with Mr. Martin H. Buehler as secretary and treasurer. This newly-chartered corporation commenced operations on January 1, 1883, and the present flourishing condition of the Pennsylvania Telephone Company is the best evidence of its able management. The vigorous manner in which the business was taken hold of and pushed by Mr. Ker attracted the attention of capitalists and business men throughout the territory to such an extent that inquiries were made in all directions for stock, which, however, is principally held by the original takers, and the Pennsylvania Telephone Company ranks among the leading corporations of the Keystone State.

The territory is districted into three divisions, which are respectively under the supervision of superintendents, and are known as the Southern, Central, and Eastern. The service has been greatly improved, and the number of subscribers to each exchange increased—some have doubled. Several flourishing exchanges have been established, and in every division trunk lines have been built and private lines constructed. Reading City, Pottsville, Lancaster City, Columbia, York, Carlisle, Harrisburg, are all connected, and conversation is satisfactorily carried on between these points. Notwithstanding the rapid growth of the business of this company, the work has just commenced, and the people are beginning to realize the value of the telephone.

The population of the territory owned by the Pennsylvania Telephone Company, according to the census of 1880 is 1,240,291, and any one familiar with the resources of the State and the location of the counties named, will at once realize the fact that they comprise the richest coal and agricultural districts in the State, and that the territory is destined to growth as rapid as in any part of the world.

Telephone connection has been made between Washington and Annapolis, and between Baltimore and the latter city. The wires were experimented with on Friday and Saturday last and found to be in perfect working order. Next week the company proposes making other connections. Messages between Washington and Annapolis will be twenty-five cents.

A bill in equity has been filed by counsel for the American Bell Telephone Company in the United States Circuit, against the Penn Overland Telephone and Telegraph Company, of Delaware, and Morris H. Alberger, Charles D. Middleton, E. C. Amer and F. H. Greene, of this city, and the Overland Telephone Company, of New York. The complainants aver that the defendants have infringed their rights in letters patent to both telephone receivers and transmitter. They ask that the defendants be enjoined from using the inventions, and that they be decreed to pay royalties for the time that they have had them in use.

The annual meeting of the stockholders of the Domestic Telegraph and Telephone Company was held on Monday last. Newark is fast becoming one of the leading cities in electrical matters, and as the art advances new developments bring with them the demand for labor. The Domestic Company shows this very plainly. They employ fifty-four persons in constructing and maintaining their lines and operating their business in all its departments, and it has grown to be of importance to our community and to all having use for the telegraph and telephone. Newark being one of the largest telegraph centers in the United States, we have the advantage here of both the principal systems. The offices of the company are lighted by the Weston incandescent system, supplied from the Mechanic Street station.

At the meeting to-day directors were elected for the ensuing year as follows: George W. Hubbell, Enos Runyon, Marcus L Ward, Jr., John D. Harrison, Jabez Fearey, E. Luther Joy, Edward Weston, Frederick T. Fearey, and Jacob H. Dawson, Jr.

The annual report of the company, presented to the stockholders by the Executive Committee, contained some facts of general interest. There are now 224 call boxes in places of business and residences. During the year four fire calls were responded to and the department notified. The twenty-nine messengers have performed no fewer than 104,289 errands during the twelve-month. Forty-one offices and stores use the company's burglar alarm, central office system, and twenty-eight places have been found open after having been closed at night. No articles of value had been taken in any case, as the alarm is instantaneous, and gives no time for the thieves to work. Five special police officers are employed in this department.

There are now 556 subscribers to the telephone exchange, and the enormous number of 1,016,895 calls have been answered during the year. In this department fifteen fire calls have been answered and the department notified. There are 658 miles of wire in use, and the company employs fifty-four persons.

The paid-up capital of the company is $100,000, on which they pay to the city of Newark the same rate of tax as individuals pay upon their personal property, the total tax this year amounting to $2,060. Separate wires are run from the central office of each telephone subscriber, and all the latest improvements in call-bells, switches, operating tables, and other valuable changes have been added to the system.

Building Lines in Nebraska and Iowa, with a Project for Des Moines.

THE AUTUMN HAS BEEN A BUSY ONE AND THE LATEST SCHEME IS THE BIGGEST — NEBRASKA AND IOWA COMPANIES JOIN LINES —THE GROUP OF CITIES AND TOWNS.

Mr. Flemon Drake, general manager of the Nebraska Telephone Company, has returned from a trip over this State and western Iowa, to close up the construction for the year, the line between Fremont and Columbus, which is to be built in November, only excepted.

Since the first of August the company have done a vast deal of work. They have put up a second wire between Omaha and Lincoln; built a line from Ashland to Wahoo; a line from Lincoln to Seward taking in Milford; a line from Lincoln to Crete and Wilbur; and best of all, a line from Lincoln to Wymore. This line is fifty-four miles long, constructed of No. 6 wire, with thirty-five poles to the mile, forming the strongest line in the West. Over this wire connection is as easy as between a local subscriber and the Omaha central office.

In Iowa the company has built from Council Bluffs to Avoca, a distance of forty miles.

The Nebraska company has now altogether 420 miles of lines connecting different cities and towns in this State and in Iowa. They now afford communication, *via* Plattsmouth and Glenwood, with Red Oak and Atlantic, and propose to open a line through to Des Moines in December. Except under the most favorable conditions, it will be impracticable to telephone through from Omaha to Des Moines, but the messages will be repeated at Atlantic. It would be possible by building a line through from Omaha to Des Moines without intermediate stations to speak directly, but such a line would not pay.

Omaha is now connected with a system embracing Lincoln, Plattsmouth, Blair, Arlington, Fremont, Elkhorn City, Papillion, Springfield, Louisville, South Bend, Ashland, Wahoo, Greenwood, Waverly, Milford, Seward, Crete, Wilber, Beatrice, Blue Springs, in Nebraska; and Council Bluffs, Weston, Underwood, Neola, Minden, Avoca, Pacific Junction, Glenwood, Malvern, Emerson, Red Oak, Atlantic, Griswold, Hastings, Hillsdale, Malvern, in Iowa. All of these, except the towns named after Avoca, are built and controlled by the Nebraska Telephone Company.

This journal has heretofore described the progress made by the Empire State Telephone Company in crossing the state with "hello's." That progress is not yet completed. Now a connection has been completed between this city and Rochester by an extension from Honeoye Falls by the Buffalo Bell Company to the Flour City Assistant General Manager Timpson tested the line to-day and reports it to be working admirably. The distance to Rochester through the different towns through which the line passes is about 78 miles, and the resistance of the intermediate stations is equal to at least 90 miles more. The Company are now stringing a large through wire which will be complete in about a week, when still better results may be expected.

Owing to an increase in business two through wires have just been constructed, one from Rochester to Palmyra and the other to Newark (on the direct road). This with the present local line touching the immediate points between Rochester and Clyde, affords Wayne County ample telephone facilities, and in case of accidents on the lines west of Geneva, these lines can be utilized by Auburn via Geneva and Lyons and intermediate points.

Besides the advantages above mentioned, the Empire State Company has completed this month a line from Penn Yan to Branchport connecting with the New York and Pennsylvania Company at the latter point to Pultney, Hammondsport, Bath, Corning and Hornellsville. Also a line from Dundee to Rock Stream, connecting with the New York and Pennsylvania Co. with lines to Reading Center, Weston, Albany, Tyrone, Watkins, Havana, North Hector, Burdett, Reynoldsville, Bradford, N.Y., Pine Valley, Millport, Kuaona, Wheeler, Prattsburgh, Hammondsport, Howard, Trumansburgh, Ithaca and Corning, Big Flats, Horseheads, Elmira, Jacksonville, Hornellsville, Canister, Rexville and Greenwood. Also a line from Cortland to Ithaca taking in the intermediate towns of Dryden, Ettenville, Freeville, McLean and connecting with the New York & Pennsylvania Co. exchange at Ithaca and the trunk lines to Trumansburgh, Slaterville, Caroline, Speedwell, Newfield, Berkshire, Candor, Newark Valley, Spencer, Watkins, Sayre, Athens, Smithboro, Van Ellenville, Tioga Center, Waverly, Owego and Binghamton.

The lines now under construction by this company are the extension of the present Aurora line to Sherwood and Poplar Ridge with the expectation of extending to Ithaca. The line from Auburn to Moravia being extended to Locke and Groton with a line to Cortland and another to Ithaca. These lines will connect with all the towns and cities in the southern tier controlled by the New York & Pennsylvania Telegraph and Telephone Company. The company is also building a line from Canandaigua to Penn Yan via Rushville and Potter's Center and a line from Penn Yan to Dundee and Rock Stream and Crystal Springs. Probably few companies have made as much progress in extending their lines as the Empire State Company whose headquarters are in this city. Most of the cities and towns of this State are being rapidly connected up, and with the exception of Syracuse, this will form an almost continuous circuit of lines east and west through the State.

The Terms of the New England and the Bell Companies Agreement.

The terms of the consolidation of the American Bell Telephone Company's local interests with those of the New England companies controlled by the Lowell syndicate are published. The companies with which the Bell Telephone Company is to consolidate are the Boston and Northern, the National Bell, of Maine; the Suburban, the Bay State, and the Granite State. The new company is to have a capital stock of $12,000,000, and it is to be distributed as follows: National Bell, of Maine, $1,350,000; Boston and Northern, $980,000; Bay State, $840,000; Suburban, $603,700; Granite State, $121,500; Boston (for property, &c.), $1,947,600; American Bell, $4,058,400; making a grand total of $9,901,200. Of the balance of $2,098,800 of stock remaining in the treasury, $1,238,300 is to be sold for working capital and $860,500 given to the American Bell Telephone Company for the franchise. The American Bell Telephone Company is to sell and the new company is to buy Boston for $1,947,600 of stock, for the plant, property, &c., and $1,947,700 of stock for the franchise. Licenses in perpetuity for exchanges, for extra territorial connecting lines and for a supply of telephones for private lines or other purposes, will be issued by the American Bell to the new company for the States of Massachusetts, Vermont, New Hampshire and Maine, excepting such parts thereof as are now under contract to other parties than those above mentioned, such exception, however, not to include the city of Boston, on further condition that the new company enters into a contract with the American Bell to give it in consideration of the licenses above mentioned 50 per cent. of any increase in its capital stock above $12,000,000.

All stock which the American Bell Company is to receive is to be fully paid up, and not subject to any assessment or contribution. The new company shall not, without the consent of the American Bell Company, borrow money for the purpose of extending or developing its business. The new company is to assume and pay all State, county and other taxes on account of or by reason of the instruments or the business done under said licenses. This, however, is not to be done unless the corporate franchises of the American Bell Company are assessed by the State of Massachusetts. In case the new company shall arrange to acquire new licenses in New England, the American Bell Company will add the territory covered thereby to the licenses proposed to be given to the new company, it being understood that such acquisition shall be made by an increase of the capital stock above $12,000,000, and that the American Bell Company is to receive 50 per cent. of such increase, except in case of the acquisition of licenses issued in perpetuity by the American Bell Company, provided, in case of the purchase of the licenses and properties of the Southern New England Telephone Company, that the so-called inter-State license, in so far as it relates to lines connecting with points outside of New England, shall be surrendered to the American Bell Company, it being the object to confine the licenses to lines both ends of which are in New England. All branch line contracts made by the American Bell will be

given to the new company for the simple payment of rentals, less a discount of 30 per cent., and the new company will have exclusive right to use or rent telephones for all purposes, except for the transmission of general business messages, market quotations, or news for sale or publication. Stock dividends were paid as follows: For the quarter ending September 30, 1884, on $720,000; for the year ending September 30, 1885, on $1,320,000; for the year ending September 30, 1886, on $1,920,000; September 30, 1887, on $2,520,000; September 30, 1888, on $3,120,000; September 30, 1889, on $3,720,000; September 30, 1890, on $4,320,000, and September 30, 1891, on $4,918,900.

The lines and branches of the Central New York Telephone and Telegraph Company are being extended all the time. A line is now being built from Clinton to Hamilton, N. Y. The latter village, Eaton, Madison and other points, will then be in connection with Rome. The line reaching Oneonto will be extended from that place to West Davenport, Davenport Center and Davenport. Mention has already been made of the line running from Norwich south to Binghamton. This will give Norwich subscribers communication with Whitney's Point, Lisle, Elmira, Owego and other points.

Operated by Telephone.

The first railroad, so far as heard from, to adopt the telephone for the usual service required of the telegraph, is the new road just built by George Hiles from Remington to Vesper, through Wood County. By this method Mr. Hiles is enabled to operate his line without expert telegraph operators, and will make quite a saving in this direction. The line will cover about twenty miles of way.—*Milwaukee Sentinel.*

The Telephone Service at Kansas City.

The Kansas City *Review* says that the telephone service of Kansas City is about to enter upon a new and greatly changed era. Those vexatious delays and uncertain connections, which have caused many righteous men to desire, and often attain, profane heights where their feelings could be vented consistent with the telephonic demands on them, bid fair to soon become features of the past.

As has been the case with other cities we have outgrown the telephonic system, so called, that was constructed when this electrical wonder was in its infancy—and its use and abuse unknown, and for eight months past have been experiencing the discomforts of what, in telephone parlance, is known as "reconstruction"—constructing anew the entire telephonic system of the city. The most difficult part of the outside work was that of setting larger and stronger poles in place, and transferring to them the multitudinous wires that loaded, beyond their capacity, the unsightly poles that have been a feature of our streets since the advent of the telephone.

The new cedars and chestnuts as a rule are straight and clean, and when painted, as they are to be, will be a decided improvement in appearance as well as efficiency. For a distance of a block, and sometimes two, from the new operating room at the corner of Sixth and Delaware streets, fifty wire cables have been strung, doing away with the necessity of that multiplicity of wires at the "central office," where so much of the line "trouble" has had its origin in the past. This is a new and quite expensive departure in telephonic circles, and, if as successful as the cable inventors predict, will greatly aid in solving the aerial wire problem. Each wire is insulated, and maintains its individuality from cable-box to operating-room. On each pole, where a cable terminates, a cable-box is secured and here the cable is "stripped," each wire carried to a screw and burr over a lightning arrestor, and out to its proper pin by means of kerite wire, and then connected with the subscriber's line, constructed of No. 14 steel wire. The lightning arresters are for the purpose of carrying the electric charge, that the heavens may send to mother earth, preventing it from entering the cable, burning through the insulation and reaching the operating-room, where the damage it could do in a second can scarcely be estimated. The cables are supported on No. 4 iron wire, so hung that there is no strain on the cable. At the operating-room, where the strain on the office pole caused by the weight of the cables is something enormous, a very elaborate system of "guying" has been constructed, and the poles evenly held in place that in all probability they would retain their position were they sawed in two.

The outside work, which will increase the capacity more than one hundred per cent., and, it is predicted, improve the service so that "trouble" will be reduced to the minimum, is but one of the elements in the improvements being made. The operating-room on the fourth floor of the Wales Building, Sixth and Delaware streets, is just now receiving its finishing touches. No one except those engaged in the practical management of an exchange, appreciates the difficulties to be overcome in handling the connections that subscribers may call for in a large exchange. The ELECTRICAL REVIEW, of New York, says:

"The people at large, uninformed of the difficulties of the undertaking, are surprised and disappointed that electricity, after giving them so wonderful an instrument as the telephone, hesitates to make the use of it conveniently universal. It is difficult to persuade them that there is, physiologically speaking, *ten times* the amount of valuable inventive tissue already expended on telephonic apparatus that there is on the telephone itself. It is a misfortune of the telephone business that the difficulties in the way of prompt and reliable service are not properly appreciated."

The above paragraph appears in an article accompanying a full page illustration of the new switchboard of the Kansas City telephone exchange. It is known as the "multiple switchboard," and consists of two more switchboards, to each of which is connected all of the lines of the subscribers of the exchange, and it is designed to enable many switchmen (or switchladies, as young ladies are to be the operators in the city hereafter) to operate the same wires on the different boards without interference. A simple test is provided by which the operator can tell instantly, without questioning another operator, whether the line desired is free or "busy." The spring-jack (the receptacle for the connecting plug) used with the board is a small and peculiar looking combination of phosphor-bronze spring, screws and burrs and insulating compounds. The spring and contact point, against which the spring nominally rests, are both insulated from the frame of the jack which is connected by an independent wire to all its duplicate frames. In the Kansas City office three switchboards are in place, giving a capacity of six hundred wires. Others are to be added. All the lines come to the first board from the cable, which is carried under the floor to the back of the switchboard, where it is separated and each wire numbered. They are then carried to the same number on the switchboard, connecting to the spring of the jack, passing through the spring and the contact point without touching the frame of the jack, the wire continuing to the same spring on the second board, and from there to the third, and then returns to the subscribers' signalling board, where it passes through the "drop" (also numbered the same as the switchboard connection) and thence to the ground. All wires are run in this manner; from cable to first board, from that to the next, and so on to the last, and from that to the annunciators, and from there to the ground. A subscriber can be called up from any of the duplicates, or be answered from any, but the idea of the board is to have each operator answer one hundred subscribers, and be able to connect them with all other subscribers, be they two hundred or two thousand. Two operators stand, or perch on stools, in front of each board, the annunciators at their sides. For example: should subscriber No. 80 call for connection with No. 430, the operator at the board where No. 80 comes in quickly tests, by means of a plug applied to the duplicate of No. 430, whether that line is busy or not, and if not, the two are promptly connected by plugs and cords. The test plug is in circuit with a battery that sounds forth a warning "click" when applied if the line wanted is busy; if not busy there is no sound at all. When through talking the subscriber calling is expected to "ring off," which throws down the clearing out-drop immediately back of the set of plugs and cords that connected the two, and thus signals the operator that they are through. The failure of the subscriber to "ring off" is a very decided source of annoyance in all exchanges.

To set up switching apparatus of this kind, trace out thoroughly, and test the thousands of wires necessary, is a task requiring the finest skill. To be able to do this and yet conceal every wire and every connection, shutting out all that might be termed unsightly, requires not only skill but also superior taste. The privileged visitor to the Kansas City Exchange, of to-day, is greeted with a vision of elegant switchboards of cherrywood, a room handsomely carpeted and richly papered, and pretty young lady-operators, who in soft and pleasant tones are answering subscribers. No loud talking is heard or permitted, and the thousands upon thousands of connections asked for daily are, as a rule, made quickly and easily.

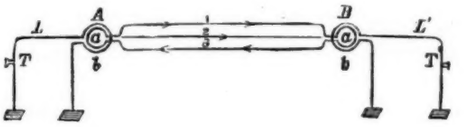
This work from its conception to its close has been under the personal supervision of Mr. E. L. Smith, General Superintendent of the Missouri and Kansas Telephone Company, and Mr. Chas. W. Price, Manager of the Kansas City Exchange. These gentlemen take a just pride in the work they have done, and to-day have the honor of being the executive officers of what has been pronounced by leading electricians the finest telephone exchange in the United States. And Kansas City, now looking forward to better things in the telephone service, can feel proud that she has in her midst a company with the capital and enterprise to carry through this work, with its thousand and one annoying features, to so successful an end. To spend not less than $40,000 in improvement of what is one of the greatest public conveniences and necessities of the present age, is a creditable thing for any company to do, and this is what the Missouri and Kansas Telephone Company has done for Kansas City.

Nystrom's Telephonic System.

When there are several line wires on one line of poles, simultaneous telephonic communication on two or more conductors is rendered difficult, or even impossible, in consequence of the communication passing through one wire being heard on the others, an inconvenience which, however, can be remedied, as is well known, by employing a return wire for each telephonic circuit in the place of the earth. This arrangement should be so arranged that the telephonic current goes in opposite directions through the two wires.

In order to take advantage of this combination, when it is employed to work between two telephonic centres, the subscribers being connected to the latter by single conductors, I have devised the following arrangement, based upon experiments which I have already described:

An induction bobbin, *a*, *b*, the coils of which are adapted to the resistances of the wires they are required to work over, is placed at each of the telephonic centers, A and B. One of the coils, *a*, of each bobbin is placed, in the manner indicated by the figure, in permanent communication with the double conductor between the centres. One end of the second coil, *b*, is in permanent connection with the earth at the central stations. The ordinary commutator of the stations allow any single conductor to be placed in connection with the second end of the coil, *b*. The further extremities of the subscribers' lines are connected to the earth in the usual manner.



The current which is produced when subscriber, T, telephones over his local conductor, L, circulates through the coil, *b*, and acts by induction on the coil, *a*. The result, as indicated by the arrows in the figure, is that a current circulates in the wires 1 and 3, which are connected through the coils, *a*, *a*. This current, which at the opposite station passes through the coil, *a*, produces there, in its turn, an induced current in the single conductor, L, which is in communication with the subscriber, T^1. By this means several double conductors can be simultaneously employed for telephonic purposes, without the disturbances first referred to taking place; and, moreover, a conversation can be held by means of a single conductor between two central stations, although the electric currents between the earth plates of this single conductor produce a considerable disturbance.

The figure shows a single wire, 2, placed midway between the two wires, 1 and 3, which form the double conductor. The wire, 2, exercises, it is true, an inductive action on wires 1 and 3, but this action is such that the effect on one wire is neutralized by the effect on the other. In the same way wires 1 and 3 act by induction on wire 2, but the effects being equal and opposite no disturbance is produced. It is a remarkable fact that it is not necessary for wire 2 to be placed *between* the others; it will answer equally as well if it is placed below them.

The intensity of the sound is not materially affected by this double translation system; in fact, the effect is as good as that obtained on a single conductor. This fact is the more remarkable as the currents produced from an ordinary induction apparatus at one of the stations are too enfeebled by the translation in question to produce the ordinary signals at the two stations. Moreover, this circumstance necessitates special arrangements for call signalling between the two stations. The best arrangement to adopt for this purpose is to employ a special wire, common to all the systems of double conductors. In this way the number of wires necessary would be the double of that of the telephonic communications which can be carried on simultaneously.

In connection with the preceding, I may relate another practical experiment. A telephonic line with four wires has been established this year between Malmo and Lund (Scanie), in order to connect the works of these two towns, situated at a distance of 18 kilometres from each other. Each pole has been coated with a sheathing of zinc to a distance of a metre from the top, and this sheathing has been placed similarly at each pole, in connection with the earth, by means of iron wire about 6 centimetres in diameter. The object of this arrangement is, in the first place, to prevent conduction along the poles from one wire to the other, and also to act as a lightning discharger. When, at the commencement of July, the line had been employed for telephonic purposes, it was immediately found impossible to use two or more conductors for simultaneous communications. Even when only the upper and lower wires were employed, a telephonic communication on one of the wires affected very considerably a communication on the other. It appeared, then, that the suppression of conduction along the poles did not prevent the transmission of the telephonic effect from one wire to the other. It was, then, that recourse was had to the induction arrangement described, and experience has proved that it entirely answers the required purpose.—*Journal Telegraphique.*

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The Transformation of Light into Sound.

Our telephone readers, especially, will be interested to know that Prof. Tyndall has been making careful inquiry into the remarkable discoveries announced by Prof. Bell at the time of the invention of the photophone, in relation to the action of an intermittent beam of light upon various substances upon which it was thrown.

While the experiments of Prof. Tyndall do not point immediately to anything of practical value, they are worthy of consideration, because any new facts or laws that employ common tools and methods may, in other hands, result in useful inventions.

The photophone showed that an intermittent beam of light could be made to reproduce its vibrations as sounds that could be heard in a telephone.

In the experiments referred to the sound is made directly audible without the aid of the selenium receiver of the photophone. A beam of light from a lime-light, or even a candle, has its rays rendered parallel by a reflector, and is directed upon a small glass flask. To the neck of the flask is fastened a rubber tube, having at the end an ear-piece. Between the flask and the source of light is set up vertically a disk of sheet metal, having radial slots cut in it near the edge, or having the edge cut into deep notches or serrations. This is made to revolve swiftly on its axis in the beam of light, alternately allowing the light to pass through the slots or between the serrations. By this arrangement the beam of light may be made intermittent or broken up into a succession of alternate flashes of light and shadows. The flask is then filled with various vapors or gases, and the beam of light, falling on these, imprints its vibrations of heat and cold (not light, but obscure heat, for all the light may be cut off and the effect is the same), and the vapor or gas expands and contracts in exact unison with the vibrations.

If these vibrations are sufficiently rapid, they may set up in the flask a musical tone that may be distinctly heard through the rubber tube.

Different vapors and gases give different results, some giving out powerful notes that may be heard without the aid of the tube.

For the purposes of experiment, carbonic acid and olefiant gas have been found best.

These experiments open a wide field for research that may yet lead to important results. No intimation has been given that a patent will be placed on these photophonic discoveries, and any one is at liberty to follow the experiments so happily begun on two continents.

It is pleasant to record such endeavors in what may, perhaps, not erroneously be looked upon as the domain of pure science; it is encouraging to know that there are some, and those eminently capable, who, resisting the temptations of practical work, with its attendant gains, can, at least for a time, give themselves up unrestrainedly to the work of the closet.

The Late Exposition at Vienna.

The Vienna Electrical Exposition was closed on Saturday last in the presence of twenty thousand people; the Crown Prince Rudolph making the closing address.

This exposition opened on August 16, and from that time up to its close it attracted a constant stream of visitors from all parts of the globe, and if the letters written by many of these visitors may be looked upon as evidence, the excellence of the display fell little short of the most sanguine expectations.

The official classification of the various exhibits comprehended eighteen groups, and many classes. Practically, however, the exhibition was composed of two parts. The first included the telegraph, the telephone, and innumerable scientific applications; the second part comprehended the electric-light, the transmission of electrical energy and all the various contrivances by which electrical energy is transformed into mechanical energy and the reverse.

This exhibition has been as valuable to the investigator and inventor as it was interesting to the casual visitor; for it demonstrated to him what others had done or were doing in his particular field, and as some of the most valuable improvements in electrical science have been made within the last few years, this information could not help but be of great assistance.

The improved radiophone, shown at the exposition, deserved all the attention it received, for it would seem to be far more perfect than that exhibited in Paris in 1881. By means of the new apparatus made by Baudot, it demonstrated that sounds could be intelligently transmitted by means of light. By this radiophone, six dispatches were transmitted simultaneously by the same wire at the rate of 9,000 words per hour. The Meyer type of radiophone, exhibited ten years ago at Vienna, has been so much improved that now it is capable of transmitting 5,000 words per hour.

A very ingenious telephone was exhibited by the well-known English electrician, Prof. Preece, in which many of the difficulties heretofore existing, and which prevented rapid communication between individuals in the same district, are remedied.

Numerous block-signal systems were exhibited, some of which had much to commend them. One, especially, an automatic system invented by M. Ducousso, would seem to possess unusual merit. There are those, eminent electricians, too, who are inclined to look with no little disfavor upon all automatic systems where human life is at stake; but there is reason to believe that a well-constructed automatic system of signals is more efficient than one controlled by railway employes of the average reliability.

A very singular feature of electrical exhibitions is the fine displays of the gas people. Let these people go into an exhibition with whatever object, their efforts are almost sure to result in proving the same thing, viz., that gas is of more value as a fuel than as an illuminant. The Vienna Exposition was no exception to the rule. The display of the gas-people was elaborate and costly, and it seems to have affected every one the same way. No one says anything about the new type of gas burner, which, it must be said, gives a very fine-looking light; but all are impressed with the value of gas to drive engines, and especially dynamo-machines.

This exposition has been of so much service to electricians generally that we look forward to the Philadelphia Exposition in 1884 with pleasant anticipations.

Last Sunday a New York daily paper devoted two columns of valuable space to what might be called a tirade against the voltaic arc system of electric lighting. This was simply one of those periodic and unthinking attacks, which electricians, as well as all other classes of scientific workmen are subject to from uninformed or misinformed persons.

This being the case, we should have paid little or no attention to the matter, but that the hand of a well-known electrician is, to our thinking, so plainly visible from the beginning to the end of the article in question, that our di-appointment at thus finding the cause betrayed by a friend, gives us pause, as Shakspeare would say.

Abuse of the voltaic arc men and their methods, if coming from one not directly interested in electric lighting, would amount to little more than an offense against good manners; but coming from a man who is trying to introduce a rival system, and joined to a flagrant puff of that system, would seem to be a somewhat direct departure from the paths of fair dealing.

It is not our custom to beat about the bush and make insinuations against any man, and therefore it is that here and now we give it as our belief that the aforesaid article, or at least the statements that it contains, were given the reporter by Mr. Thomas A. Edison. If we are wrong in this, we sincerely ask Mr. Edison's pardon; and when it is proved to us that we have made a mistake, we will take the earliest possible opportunity to correct the statement made here.

It would seem but fair, since we have made the accusation to produce the evidence—all of a circumstantial but none the less reliable nature—which has induced us to form the opinion.

The readers of the REVIEW will remember that not so very long ago, Mr. Edison, interviewed by the representative of a Boston publication, abused the storage battery and the arc system with such vindictiveness, that the attack failed utterly of its object, and led intelligent people to believe that he was jealous of the success of these systems.

An English scientific publication characterized the statements contained in the interview as ridiculous, and apologized for reproducing it by saying that, coming from Mr. Edison, it was likely to have some weight with those unfamiliar with the subject, and might therefore be looked upon as important.

It would not, it seems, suffice Mr. Edison, who, as we all know, is in the incandescent business, to put a sign in his window, as the tailor did, with the legend, "No connection with the shop across the way!" No, no; he must have open warfare—no, not *open* warfare, for open warfare is legitimate—but sly warfare.

It is said that when Mr. Samuel Weller testified in the now famous case of *Bardell vs. Pickwick*, he hit upon the happy idea of saying as much about the other side and as little about Mr. Pickwick, his master, as was possible. In like manner, Mr. Edison, when opportunities offer, says as much against his rivals' systems and as little about his own as circumstances will admit. Were they so minded, which, happily, they are not, they might retaliate in kind, and we dare say they could say some very sharp things about their censor and his system.

The few accidents to life which have occurred since the inception of the practical utilization of the voltaic arc systems, are carefully enumerated in the article in question. Yet nothing is said about the fact that the arc system applied to general lighting is new, and that improved methods of introduction are being found almost daily.

Looking over the entire voltaic arc field, six cases of death are found to have occurred—one in England, two in France, and three in this country.

Let us compare this showing with the gas field. Since 1878, *one hundred and fifty-three* cases of death are recorded as having been directly attributable to illuminating gas in New York City alone!

Let us turn to what our critic has to say about the dangers to firemen:

"As for the dangers to which firemen are exposed by the arc light wires, they are so great that, were they generally known, I have no doubt the knowledge would materially affect our fire service, possibly excite such feelings as to enforce suppression of this most perilous system, or at least the burying of its murderous conductors deep under ground. Not only by actual contact with the wire itself is the fireman likely to be killed instantly, but in either of two other ways. Suppose that a hose is attached to one of the metal pipes—'stand-pipes,' I believe they are called—with which our large modern buildings are now supplied for throwing volumes of water through branches into any story where it may be required, and that one of the arc light wires comes in contact with that metal pipe. The tendency of the current being always to return to the dynamo by the shortest path, it naturally seeks the earth, but, since this pipe terminates upon the wall of the building a few feet from the earth, the current will pass from the pipe through the stream of water—water being, as you doubtless know, a good conductor—and through any other conductor which may intervene between that stream of water and the earth. If that stream, so charged, should be applied directly upon an individual who happened to be standing upon the ground—wet ground particularly—the current would pass through his body, and in all probability kill him instantly. It only requires for that, that the pressure of the current should be sufficient to overcome the natural resistance of the water of the human body interposed in its path. The other danger

threatening the fireman, apart from his personal contact with the wire, is through the streams of water from a nozzle held by him, which, if it come in contact with an arc light wire in which the electricity is at high pressure, is liable to instantly offer a new path for the subtle and deadly fluid. Suppose the man standing on wet ground, grasping with wet hands a metal nozzle, making in this way a connection with an arc light wire somewhere near the dynamo, where the pressure is greatest, the insulation on the wire would be instantly destroyed—for the force of the current is sufficient to pierce a plate of glass half an inch thick—and the death-dealing spark would reach the man and kill him infinitely quicker than thought."

Now what are the facts? A stream of water will carry the current to the ground without injury to the fireman, for the human body offers a greater resistance to the current than does water. Nor will touching a pipe, not directly connected with the arc light circuit, insure a shock, for the very good reason that the pipe offers considerably less resistance to the passage of the current to ground than does the human body.

Thus, we would inform the firemen that they may have no fear of throwing streams of water across the arc wires, nor of touching the water pipes affixed to burning buildings.

In closing, we cannot forbear expressing the hope that we may be found to have been mistaken in charging that this very unfair article was inspired by Mr. Edison. We have great respect for Mr. Edison, and the charge of anonymously attacking rivals in business smacks rather more of the pettifogger than of the reputable electrician that we have always believed Mr. Edison to be.

Fair play is a jewel!

The New Electric, Manufacturers and Miscellaneous Stock Exchange.

The modern test of values is an open market where every man can see for himself what others are willing to pay for whatever is on the market for sale. The demand for this test has given rise to the city marts called exchanges, and their values in turn are governed by the *bona fide* character of the transactions.

The result of these open sales has led to placing the stocks and other securities of commercial enterprises upon the market in such a shape that their standing upon the exchanges will give them a character with banks and other moneyed institutions, so that they may be used as collateral securities for commercial transactions. The railroads of the country have long been in the habit of taking advantage of this method of obtaining a standing in commercial circles. Following in the line of this example, a number of business men have associated themselves under the title of the Electric, Manufacturing and Miscellaneous Stock Exchange, for the purpose of creating a mart for the sale of such stock as are not listed and offered for sale on the New York Stock Exchange.

A large room has been secured in the basement of the Duncan Buildings, corner of Nassau and Pine Streets, New York City, which will be ready about the fifth of December for the commencement of operations. With a view of finding out what could be learned about this undertaking a representative of the ELECTRICAL REVIEW called upon the officers and was favored with the following information. To the question, What success has the company met with in commercial circles? Mr. Albert H. Jocelyn, the secretary, answered, "We are obtaining for membership the best men in New York commercial circles, and as an evidence of this I submit the following communication signed by such men as the presidents of the Third National Bank, The Fourth National Bank, The Chatham National Bank, The St. Nicholas Bank, &c.:

NEW YORK, 1883.

To A. H. Jocelyn, Sec'y:

We have no hesitation in saying it would be a great convenience to the Banks to have a daily quotation such as your exchange will give to the many valuable securities which are now not listed on The New York Stock Exchange. It would also enhance the value of such properties by making them more available as collateral.

The New York Stock Exchange has as many railroad stocks now listed as they can give proper attention to, while the stocks of electric companies now represent twice as much in value as those stocks in public estimation, and should therefore be allowed to represent the conspicuous position in the public market that their value warrants, for they in fact are based upon a better commercial value.

The value of telephonic interests has grown immensely of late years, and now represents a plant interest of $30,000,000 more than that of telegraphs, while the prospective possibilities of the electric light promise to be more valuable than the present values of telegraphs and telephones put together. For these reasons we deem it ample time to open an exchange for the sale of these stocks, and as an evidence of the need of such an exchange, I submit the two following companies just received for listing: The West India Telegraph and Telephone Company and The Columbia and Panama Telephone and Telegraph Company. Mr. J. P. Dieter is president of both of these companies.

"What success have you met with among electricians?"

"The managers of electrical companies generally speak well of it, and the most prominent have sent in for applications for listing their stock. It is certain that electrical stocks will soon be the most prominent in the country. They already exceed in value those of mining and petroleum companies. Membership and listing are higher in this exchange than in theirs. Stock has now risen in this exchange from $100 to $250, and the books will be closed after November 17."

"What are the other advantages of your exchange?"

"Just as the New York Stock Exchange offers facilties for railroad corporations to advantageously dispose of their securities in a regular market, with daily publications of transactions and quotations, etc, thereby rendering them negotiable and available as collateral, so do we propose to give the same advantages to the growing interest in and values of electrical and other stocks."

"What guard have you set against 'cut-and-dry,' 'wild cat' and 'snide' stocks being imposed upon you?"

"That is a point against which we have taken extraordinary and elaborate precautions, and I may say that upon our good faith in carrying out this feature of our enterprise depends, in a great measure, if not entirely, our success. We have a committee made up from the best business men in the city, whose duty it is to pass upon the standing of each company tendered for listing, and no company will be accepted without their consent. In evidence of the high standing of these committees, I will give the following samples. The Committee on securities is composed of the following names: George L. Hutchins, cashier, Third National Bank, No. 20 Nassau Street; Knight L. Clapp, banker, No. 57 Broadway; Thos. C. Pollock, cashier, St. Nicholas Bank of New York, No. 7 Wall Street; H P. Doremus, cashier, Chatham National Bank, No. 196 Broadway; Ed. Hornbostel, banker and broker, No. 7 New Street; Otto Witte, Hagen & Billing, bankers, No. 1 Wall Street; Edward W. Wilson, electrical securities, No. 3 Wall Street; Geo. Pell, Grovesteen & Pell, bankers, No. 72 Broadway. The Electric and Manufacturing Committee is composed of men with equally high standing in their calling as follows: Stephen D. Field, electrician, No. 18 Broadway; Royal C. Vilas, Erie Railroad, No. 21 Cortlandt Street, R. A. C. Smith, Havana Gas Company, No. 69 Wall Street; John A. Belvin, Standard Gas Company (Limited), Astor House; W. H. H. Bowers, mechanical engineer, Mills Building; Jos. H. Parsons, vice-president, Provident Insurance Company, No. 7 Wall Street; Chas. Dimon, treasurer, Electric Railway of the United States; E. C. Oppenheim, mechanical engineer and contractor, No. 32 Thomas Street; H. M. Carlton, broker, No. 17 East 17th Street."

"What will be the other features of the exchange?"

"The stock of all companies that have an acknowledged standing that are approved by the committee will be listed and regularly called and sold. Following the regular call will be an auction of miscellaneous stocks. These will receive the full advertising of the exchange, and will be sold for one-half of the usual charges. These sales will receive the benefit of the large attendance of the exchange, and thus prove a profitable market for this class of securities. The purpose of organizing this exchange is to afford a market for all classes of valuable securities not listed on the New York Stock Exchange, with every guarantee that can reasonably be secured of the *bona fide* nature of all offerings. We think the following list of officers gives assurance that this purpose will be faithfully carried out:

"*President*—George M. Hard, president Chatham National Bank, No. 196 Broadway.

"*First Vice-President*—Chas. Heygendorff, No. 66 New Street.

"*Second Vice-President*—Niels P. Lassen, No. 236 Fifth Avenue.

"*Treasurer*—Arthur B. Graves, president St. Nicholas Bank, No. 7 Wall Street.

"*Secretary*—Albert H. Jocelyn.

"*Assistant Secretary*—William Laurent Bailey.

"*Chairman and Auctioneer*—Thomas Barclay."

Mistaking their Man.

We have watched with not a little interest the contest which has for some time been in progress, between our esteemed contemporary and neighbor, the New York *Herald* and the newsdealers.

That the middleman has a right to dictate the terms upon which he buys his goods is certainly a novel proposition, and one which there is reason to believe may not be sustained upon any principle known, either in law or practice.

If the *Herald* should force the newsdealers or any other body of men to take its papers, at its own figures, and sell them at a certain price, it would indeed be both a hardship and an injustice. But the *Herald* has neither done this nor made the attempt. It has simply reduced its price, as it had a right to do, and the newsdealers, being unwilling to sell it at the price named, looked for other agents, and finding them gave them its patronage.

The absurdity of a lot of newsdealers trying to dictate the price at which a certain commodity shall be sold can only be likened unto an attempt made by the tail to wag the dog. Those who have, like ourselves, even a slight acquaintance with Mr. Bennett, will bear us witness that he is far more generous and open-hearted than the general run of human beings. We venture to assert, without fear of contradiction, that he has given more money toward benevolent enterprises than all the editors of the New York press combined. He hasn't a mean bone in his body, and though we have watched his career for years—ever since his father died—we never heard of his doing a shabby thing; never heard of his taking an unfair advantage of any man.

When those ill-advised persons, the newsdealers, carried around in their parade a banner inscribed with the fact that James Gordon Bennett gave $100,000 to the poor in Ireland, they openly published a refutation of their own charge, that he was a hard-hearted man.

Only those having a weak argument indulge in personalities, for personalities will never serve to strengthen or sustain a cause, however just, and such a procedure always tends to disgust those who might have been looked to for support.

The newsdealers have wrongly estimated the character of James Gordon Bennett, as we know it. Though a quiet, unassuming man, Mr. Bennett is the last man to quail before the newsdealers, or any other class or order of men. When aroused by attempted intimidation he may be looked upon as game from the very start, and we will venture to predict right here, that he will rout the newsdealers, horse, foot, and dragoons, before he is through with them.

On the Imperfection of the Galvanometer as a Test of the Evanescence of a Transient Current.*

BY LORD RAYLEIGH.

In certain electrical measurements a galvanometer is used to indicate whether or not the integral value of a current of short duration is zero. For example, in the method given in "Maxwell's Electricity," sec. 755, for comparing the co-efficients of mutual induction, M, of two pairs of coils, the evanescence of the integral current through the galvanometer is made the test of the fulfillment of a certain relation between the co-efficients of induction and resistance. The two primary coils are joined up in simple circuit with a battery. The two secondaries are also connected together in such a way that the inductive electromotive forces conspire, and two points, P, Q, one on each connector, are brought into contact with the galvanometer terminals. In special cases, as, for instance, when the two pairs of coils are similar, there is no current through the galvanometer, whatever may happen in the primary circuit; but in general the establishment or interruption of the primary current will cause a deflection of the galvanometer, indicative of the integral value of the current passing. The method consists in adding inductionless resistance coils to one or other of the secondaries until this current vanishes. The required conditions are most readily obtained by supposing the galvanometer circuit broken, and inquiring into the value of the electromotive force E, between the points P and Q. The same current y, flows in both secondaries, and if x be the primary current, the equations are

$$N_1 \frac{dy}{dt} + M_1 \frac{dx}{dt} + R_1 y = E$$

$$N_2 \frac{dy}{dt} + M_2 \frac{dx}{dt} + S y = -E.$$

M_1 M_2 are the conduction co-efficients to be compared, R S the resistances of the two secondaries (with associated resistance coils), N_1 N_2 their co-efficients of self-induction.

Thus $(M_1 + M_2) E = (M_2 N_1 - M_1 N_2) \frac{dy}{dt}$ $+) M_2 R - M_1 S) y$. Since y begins at 0 and ends at 0, the integral electromotive force vanishes if

$$M_2 R - M_1 S = 0.$$

If this condition is satisfied there is no integral current through the galvanometer, and then the ratio of induction co-efficients is known by the rate of resistance. In general, however, the evanescence of the integral current is obtained by the opposition of consecutive positive and negative parts, and even although the whole duration of the effect is but a small fraction of the time of vibration, the needle of the galvanometer will be disturbed in such a manner as to make it difficult to say whether or not the whole impulse acting upon it be zero. To obtain a satisfactory measurement, it is necessary to secure at least an approximate fulfillment of the second condition required in order that the current may be zero throughout, viz.,

$$M_2 N_1 - M_1 N_2 = 0.$$

In this there is no difficulty, as we can easily increase the defective self-induction by the addition of other coils placed at a sufficient distance. The most convenient plan is to induce two coils by the variations of the relative situation of which the self-induction can be adjusted. With moderate care the initial impulsive electromotive force caused by a sudden variation of the primary current, and dependent only upon the induction co-efficients, may be made so small that the needle shows no uneasiness when the other adjustment relative to the resistances is complete.

In March, 1881, I attempted, in conjunction with Messrs. Glazebrook & Dodds, to

*Paper read before the British Association, Southport, England, Meeting, Sept., 1883.

carry out the plan above suggested for the comparison of two co-efficients of mutual induction. No satisfactory result could be obtained in the ordinary method of working, the needle showing uneasiness whatever resistances were employed, so that it was impossible to fix upon any particular value as corresponding to a zero integral current.

The addition of other coils to increase the self-induction of one of the secondaries was so far successful that the needle could be reduced to quietness, but calculations showed that the additional self-induction found to be necessary in experiment was much in excess of what the above theory would indicate. The explanation which afterwards suggested itself to me was that the anomalous effect was due to the conducting rings upon which some of the coils were unwound, and whose presence complicates the otherwise simple theory. We verified this view by bringing a coil of wire into the neighborhood of one of the principal coils, the behavior of the galvanometer needle being very sensibly different according as the auxiliary coil was opened or closed. The kind of embarrassment to which measurements of the kind are subject is well illustrated by placing the galvanometer in a tertiary circuit, not directly influenced at all by the battery current in the primary. A pair of coils with double wires, such as are often used for large electro-magnets, are suitable for the experiment. One wire of the first coil is connected with the battery, and forms the primary circuit. The second wire of the first coil and the first wire of the second coil are connected and constitute together the secondary circuit. The second wire of the second coil and the galvanometer form the tertiary circuit. The apparatus must be so adjusted that no effect is perceived at the galvanometer when the secondary is broken, whatever may happen in the primary. When their adjustment is complete, the secondary is closed, and the effect is observed of opening or closing the primary. If the contacts are properly made, the integral current through the galvanometer at each operation is rigorously zero, but in the experiments that I have made, no one could infer the fact from the behavior of the galvanometer needle. The effect may be exaggerated by the insertion of a few iron wires into the induction coils.

The H. W. Johns Manufacturing Company of New York, Philadelphia, and Chicago, have been awarded the silver medal over all competitors at the Amsterdam Exposition for their asbestos materials, liquid paints, roofing, boiler coverings, steam packings, millboards, etc.

If you wish to make a man perfectly miserable, send him an important message by telephone. Tell him to be sure to meet you at a hotel at a certain hour, say. But when he asks you who you are, don't understand him, and don't give him your name. He'll fret off a pound of flesh an hour trying to make out who it is that telephoned him.

One of our merchants received the following order from a customer a few days since: "Mr. B——, pleas send me $1 worth of coffy and $1 worth of shoogar, some small nails. My wife had a baby last nite, also two padlocks and monkey wrench."—*Stolen by the Macon Telegraph.*

A rural young lady visited the Philadelphia Zoological Garden, and when she returned home she told her mother that one of the monkeys spoke to her. A girl who can't distinguish a dude from a monkey should be given a few lessons in natural history. The monkey is the most intelligent looking, but doesn't wear such ridiculous clothes.—*Norristown Herald.*

The ELECTRICAL REVIEW for September 27th contains a very interesting and instructive illustrated article on "The Radical System of Lightning Conductors." The paper is filled with information regarding electricity, and may safely be called a lightning sheet. Delano & Co., publishers, New York. —*Manchester Enterprise.*

Manufacturing News.

The Atlanta Cotton Mills, Atlanta, Ga., have been purchased at foreclosure sale by Henry B. Plant, New York; Lorenzo Blackstone, Norwich, Conn.; Freeman Clarke, Rochester, N. Y.; Edward S. Clarke and Rufus B. Bullock, Atlanta, Ga. Rufus B. Bullock has been elected president, Edward S. Clarke, secretary and treasurer, and C. F. Coleman, superintendent.

The Railroad Commissioners of New York have ordered that the railroad station in Albany, used by the New York Central, Boston and Albany, and the Belt Line trains, be lighted by electricity. The depot is a dangerous one at night. Preparations are being made in obedience to this order, and will soon be completed.

Fifty thousand francs is the prize which France offers for the discovery which shall enable electricity to be applied economically in one of the following directions: As a source of heat, of light, of chemical action, of mechanical power, as a means of the transmission of intelligence, or of the treatment of disease—the prize being open to all nationalities, and to be awarded in December, 1887.

The highest trestle in the world is said to be the Marent trestle, on the Northern Pacific Railroad, among the mountains. It is 866 feet long, 266 feet high, and contains 800,000 feet of timber. Track has been laid across it, and a heavy construction train lately tested its stability to the satisfaction of the engineers.

The Union Steel Company of Chicago was incorporated at Springfield on the 16th, with a capital stock of $4,600,000. This is the company organized to purchase the plant of the Union Iron and Steel Company. The plan is that the creditors shall have fifty cents on the dollar in cash, or take preferred stock in the new company. All the creditors have agreed to this with the exception of those holding about $60,000 of the $2,621,000 of the old indebtedness, and new subscription books will be opened in a few days.

The Naval Bureau of Equipment and Recruiting is now experimenting with American wires, and as soon as a quality is found to meet the required standard the manufacture of wire cables will be commenced at the naval ropewalk at Boston. The Bureau has in course of construction thirty fathoms of steel cable at the Washington yard for experimental purposes.—*Chicago Journal of Commerce.*

NEW PATENTS—ELECTRICAL—1883.

INDEX OF INVENTIONS FOR WHICH LETTERS PATENT OF THE UNITED STATES WERE GRANTED IN THE WEEK ENDING OCTOBER 30, 1883.

287,401 Electric time detector; Thomas Ahearn, Ottawa, Ontario, Canada.

287,449 Telephonic repeater and relay; Jas. A. Maloney, Washington, D. C.

287,466 Electrical connection for railway signals; Thomas J Pottinger, Louisville, Ky.

287,490 Telephone transmitter: Edward L. Wilson, Boston, Mass., assignor to the American Bell Telephone Company, same place.

287,501 Method of electrical testing; Charles S. Bradley, New York, N. Y., assignor to the Edison Electric Light Company, same place.

287,509 Underground conduit; Josiah S. Du Bois, Camden, N. J.

287,511 Electric regulator; Thomas A. Edison, Menlo Park, N. J.

287,512 Dynamo electric machine; Thomas A. Edison, Menlo Park, N. J.

287,513 Dynamo electric machine; Thomas A. Edison, Menlo Park, N. J.

287,514 Dynamo electric machine; Thomas A. Edison, Menlo Park, N. J.

287,515 System of electrical distribution; Thos. A. Edison, Menlo Park, N. J.

287,516 System of electrical distribution; Thos. A. Edison, Menlo Park, N. J.

287,517 System of electrical distribution; Thos. A. Edison, Menlo Park, N. J., assignor to the Edison Electric Light Company, New York, N. Y.

287,518 Method of manufacturing incandescing electric lamps; Thomas A. Edison, Menlo Park, N. J., assignor to the Edison Electric Light Company, New York, N. Y.

287,519 Incandescing Electric lamp; Thomas A. Edison, Menlo Park, N. J., assignor to the Edison Electric Light Company, New York, N. Y.

287,520 Incandescing conductor for electric lamps; Thos. A. Edison, Menlo Park, N. J., assignor to the Edison Electric Light Company, New York, N. Y.

287,521 Dynamo or magneto electric machine; Thomas A. Edison, Menlo Park, N. J., assignor to the Edison Electric Light Company, New York, N.Y.

287,522 Mold for carbonizing; Thomas A. Edison, Menlo Park, N. J., assignor to the Edison Electric Light Company, New York, N. Y.

287,523 Dynamo or magneto electric machine; Thomas A. Edison, Menlo Park, N. J., assignor to the Edison Electric Light Company, New York, N.Y.

287,524 Regulator for dynamo electric machines; Thomas A. Edison, Menlo Park, N. J., assignor to the Edison Electric Light Company, New York, N.Y.

287,525 Regulator for systems of electrical distribution; Thomas A. Edison, Menlo Park, N. J., assignor to the Edison Electric Light Company, New York, N. Y.

287,532 Junction for electrical conductors: Calvin Goddard, New York, N. Y., assignor to the Edison Electric Light Company, same place.

287,533 Safety catch for electric circuits; Calvin Goddard, New York, N. Y., assignor to the Edison Electric Light Company, same place.

287,565 Regulator for dynamo electric machine; George J Murdock, Binghamton, N. Y.

287,608 Dynamo or magneto electric generator; Foree Bain, Chicago, Ill., assignor to the Bain Electric Company, same place.

287,609 Dynamo electric machine: Foree Bain, Chicago, Ill., assignor to the Bain Electric Company, same place.

287,610 Dynamo electric machine: Foree Bain, Chicago, Ill., assignor to the Bain Electric Company, same place.

287,611 Dynamo or magneto electric machine; Foree Bain, Chicago, Ill., assignor to the Bain Electric Company, same place.

287,618 Circuit closer for electric alarms: Leo A. Brigel, Cincinnati, O.

287,641 Electric battery: A. Floyd Delafield, Norton, Conn.

287,647 Lightning arrester; Josiah W. Dyer, Philadelphia, Pa., assignor to the Automatic Current Protector and Electric Manufacturing Company.

287,649 Electric voting machine for legislative bodies: John A. Enos, Peabody, Mass., assignor of eight sixty-fourths to George Henry Low, same place.

287,654 Indicator for electric-lighting systems; Warren P. Freeman, Brooklyn, N. Y., assignor to Wm. F. Jobbins, same place.

287,661 Dynamo or magneto electric machine; John E. Giles, Hazleton, Pa

287,664 Electric fire alarm apparatus; William Cleather Gordon, residing at the Langham Hotel, County of Middlesex, England.

287,678 Wiper for the commutators of dynamo electric machines; Robert Holbon, Alpena, Mich., assignor of one-half to Charles B. Greely, same place.

287,710 Telephone time-signal repeating system, John M Oram, Dallas, Texas.

287,742 Telephone receiver; Henry E. Waite, New York, N. Y., assignor to the Molecular Telephone Company, same place.

287,743 Telephone receiver; Henry E. Waite, New York, N. Y., assignor to the Molecular Telephone Company, same place.

287,751 Metallic wire packing; Samuel Armstrong, Newark, N. J.

287,757 Thermostatic fire indicator; Richard N. Dyer, New York, N. Y., assignor of one-third to Henry W. Seely, same place.

287,758 Electric flat-iron; Richard N. Dyer and Henry W. Seely, Menlo Park, N. J.

287,766 Insulated electric conductor; George W. McGill, New York, N. Y.

287,773 Magneto electric machine; Philip P. Nungesser, Cleveland, Ohio.

287,774 Dynamo or magneto electric machine; Philip P. Nungesser, Cleveland, Ohio.

287,775 Electric time lock; William Edgar Peirce, Newark, N. J.

287,776 Insulated electric conductor; Herbert O. Phillips, Waterbury, Conn., assignor to Holmes, Booth & Haydens, same place.

BUSINESS NOTICES.

FOR SALE—United States and Canadian rights in an arc lamp; inventor desires to sell his patents outright for a moderate sum. Address "Arc Lamp," P. O. Box 3329, New York City.

A mechanical and electrical engineer, graduate of the United States Naval Academy, desires an engagement; highest testimonials. Address G. S., 25 Bowdoin street, Boston, Mass.

FOR SALE.—One second hand 8 inch nickel plating machine, good as new, used but little.

W. B. WALLIS,
Fitchburg, Mass.

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Ebonized Wood & Mahogany, "	**23.04**
Rosewood, "	**28.80**

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It is the only book which EXPLAINS in PLAIN ENGLISH and without algebraic formulae all about Electric Measurement and the Use of Galvanometers, besides giving fully detailed and illustrated description of

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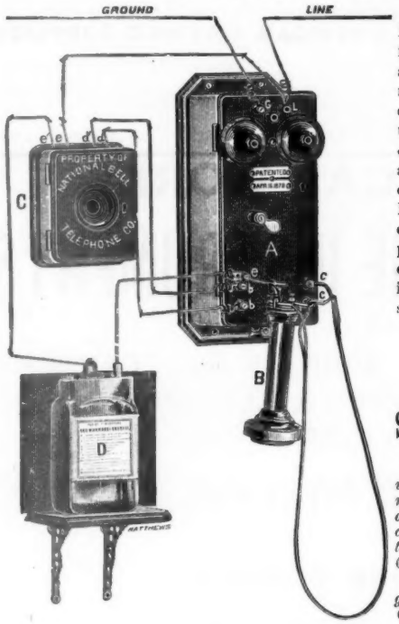

This Company owns the Original Patents of Alexander Graham Bell for the Electric Speaking Telephone, and other patents, covering improvements upon the same, and controls, except for certain limited territory, under an arrangement with the Western Union Telegraph Co., the Gold and Stock Telegraph Co., the American Speaking Telephone Co., and the Harmonic Telegraph Co., the Patents owned by those Companies, and is prepared to furnish telephones to the citizens of the United States through its local Licensees, on the following systems:

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Those desiring instruments on Private or Speaking Tube Lines, or connections on Exchanges, will please apply to the nearest Licensed Exchange, when their case will be brought to the attention of the proper local Company.

Any further information will be gladly furnished on application to the Company at its office,

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All persons using telephones not licensed by this Company, are hereby respectfully notified, that they are liable to prosecution, and for damages for infringement, and will be prosecuted according to the full extent of the law.

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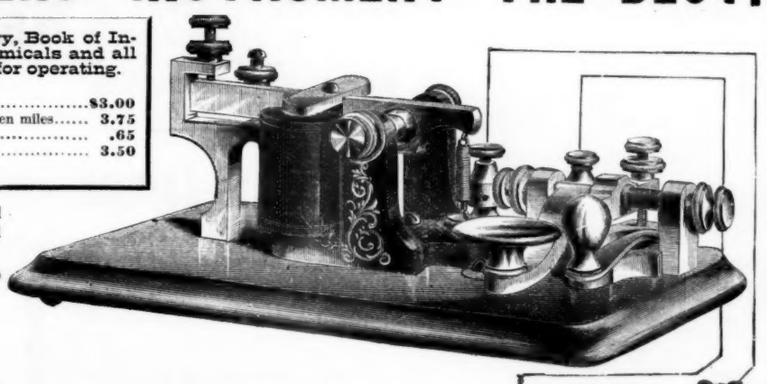

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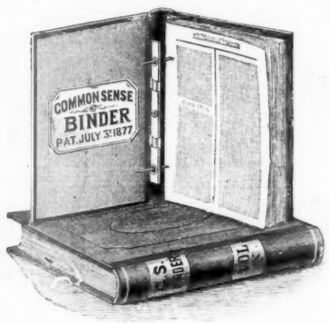

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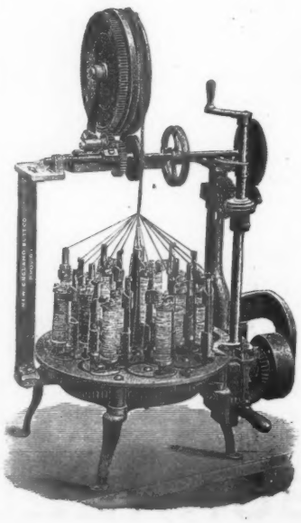

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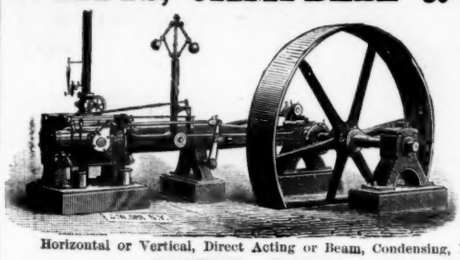

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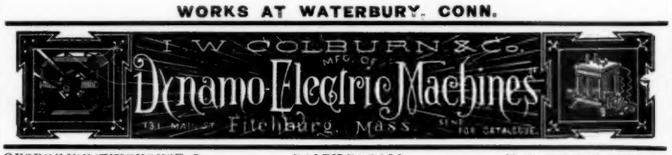

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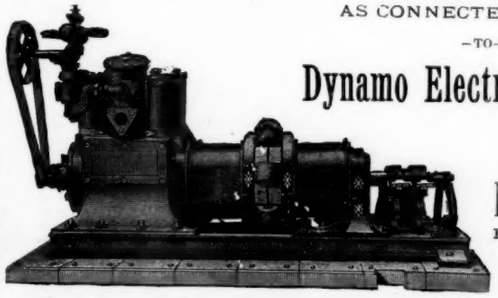

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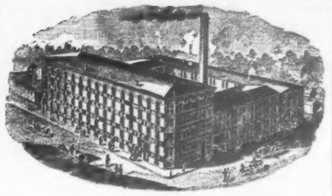

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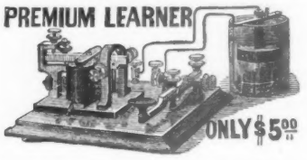

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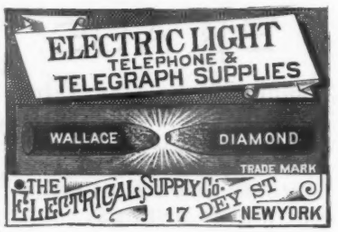

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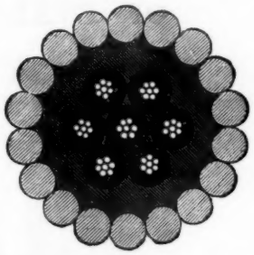

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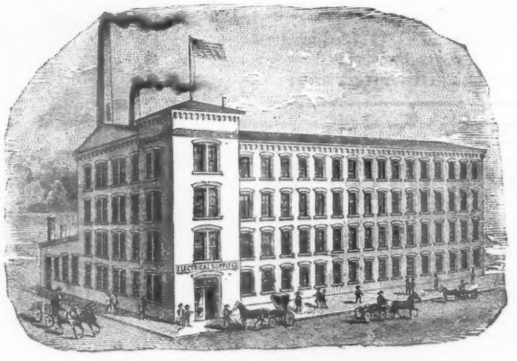

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